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PUBLIC HEALTH

PAPERS AND REPORTS

VOLUME XI

PRESENTED AT THE THIRTEENTH ANNUAL MEETING OF THE

American Public Health Association

WASHINGTON, D. C., DEC. 8–11

1885

WITH AN ABSTRACT OF THE RECORD OF PROCEEDINGS

CONCORD, N. H.
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NOTE BY THE SECRETARY.

This volume, the third edited by the present Secretary, is presented with the belief that typographically it takes rank with any of the series published by the association. In the character of the papers, the work is of the highest order in sanitary literature. The value of the report of the Committee on Disinfectants, published in full, cannot be over-estimated. Other papers of especial merit might be named. Not one has been inserted that is unworthy of the place.

It was impracticable to include the LOMB PRIZE ESSAYS in this volume, but pamphlet copies will be sent to all entitled to them. The Publication Committee have taken the responsibility of publishing these essays in a single volume (198 pages), consecutively paged, thoroughly indexed, and bound uniform with the publications of the association, which can be obtained for one dollar, post paid—a price barely covering cost.

The admirable and comprehensive index to this volume is the work of Nellie S. Abbott, of Concord, N. H., whose invaluable services in addition thereto have greatly lessened the labors of the editor. The index is an almost indispensable addition to the work, which is wanting in former volumes, and will be appreciated by all who may have occasion to consult it.

The By-Laws of the Executive Committee will be found immediately following the Constitution, the first time published.

A notable change was made in the Constitution at the last meeting of the association, which admits the Dominion of Canada, the province of Ontario, and the province of Quebec to representation in the Advisory Council. In fact, the working territory of the association has been largely increased by the voluntary *annexation* of Canada; and the com-

pact is to be ratified by holding the annual meeting at Toronto, October 4-8, 1886. This union of sanitary forces, independent of political divisions, to educate the people, to assist and encourage local sanitation, and to resist the invasion of epidemics, reflects the energy and ability of the American Public Health Association, no less than the progressive intelligence of the people.

The Secretary would take this opportunity to thank the officers and members of the association for the uniform courtesy which he has received at their hands during the entire term of his official service.

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THE PRESIDENT'S ADDRESS.

By JAMES E. REEVES, M. D.,
Of Wheeling, Va.

GENTLEMEN AND FELLOWS OF THE AMERICAN PUBLIC HEALTH ASSOCIATION:—By your kindly suffrages I have been clothed temporarily with the highest honor that can be conferred by sanitary workers in the United States, and I confess that I have reached the duties and exercises of this, our thirteenth annual meeting, and the culmination of my official privilege and distinction, with many misgivings as to my ability to meet the full measure of your reasonable expectations.

A man, it is true, may possess thoughts, sentiments, opinions, attachments; he may be animated by an ardent desire to recommend these to the belief or to the approbation of others; but in order to recommend sentiments and opinions with success, it is indispensable that he shall be able to command those easy and natural graces, those soft, insinuating arts of tone, of gesture, of expression, which must either be the gratuitous endowment of nature, or the result of a long course of assiduous application and practice.

Surely a speaker is laboring under many disadvantages who has to encounter, on the one hand, all the negative influences which result from the want of a free and frequent intercourse with the world, from the want of familiar acquaintance with the current terms and popular phrases—those silken approaches and passages to the heart, by which the convictions of man are created or confirmed; while, on the other hand, he must encounter all the positive influences which result from a retired and silent life. Besides all this, you will admit that our profoundest feelings are always the most difficult to communicate; yet at this hour, and in the presence of this large assembly of wise and good men, who have come up from the North, the South, the East, and the West, representing not only hundreds of cities and large towns in this great country of ours, but also the Canadas, bringing with them, to grace this auspicious meeting at the capital of the nation, priceless knowledge,—how to increase the duration and value of human life, and elevate humanity to the highest standard of physical, mental, and moral perfection,—I invite your attention to subjects which have encouraged the most industrious energies of my life, namely, the public health, and to that end the usefulness and welfare of the American Public Health Association, whose good name and honor have been committed to your care; and I trust it will not be

in vain if I bespeak your kind indulgence while I talk of matters which I have had so much at heart for the last fifteen years.

The success of our meetings has always largely depended upon the well directed energies of the local committees of arrangements; and I am sure every member of the association present will join me in heartily extending to Dr. Smith Townsend, chairman, J. C. McGinn, Esq., secretary, and their distinguished associates on the local committee, many, many thanks for the excellent and attractive programme they have so liberally provided for our reception and entertainment during the hours of recess. It promises,—indeed, assures,—a veritable "feast of reason and flow of soul;" and again it will be said, and justly, that "the medical profession and the city authorities of Washington never do things half-way."

But our greetings and congratulations are not unmixed with sorrow, for they link us closely with "the valley of the shadow of death." A great statesman, Thomas A. Hendricks, the vice-president of the United States—a great and good man in every phase of his life—has been suddenly and unexpectedly cut down from among the living; and the knell of the sorrowful tidings on the evening before Thanksgiving cast a shadow over the hearth-stones of millions of his countrymen. And this is not all of the sadness which, on this occasion, possesses our hearts. Since the last meeting nine master workmen in the vineyard of sanitary science, of beautiful private character and solid professional attainments, have been called off from labor to refreshment; and I am filled with grief almost too full for utterance when I think of the loss this association has sustained by the death of J. G. Thomas of Savannah, F. W. Hatch of Sacramento, Thomas L. Neal of Dayton, John J. Speed of Louisville, Richard McSherry of Baltimore, P. V. Schenck of St. Louis, W. C. Kerr of Raleigh, J. Savage Delavan of Albany, and Thad M. Stevens of Indianapolis. These dear names will never be forgotten, for they are indissolubly connected with the history of sanitary progress in the United States. Having made their best offerings at the shrine of the public health, they then "took their burden for a pillow, and laid down by the wayside to sleep that dreamless sleep" that wakes in a glorious immortality! Peace, peace to their precious ashes! The terrible question that irresistibly presents itself, Who of us shall be called next? cannot be answered. Let us therefore be admonished by the uncertainty of life, and "work while it is called to-day; for the night cometh when no man can work."

Every such an assembly as this moves forward another day's journey the ark of the sanitary covenant, and humanity is bettered and made happier thereby. A body so numerous as the one here assembled, which extends its action and influence over every part of the national domain, and is intimately connected with all the interests of society, cannot meet to deliberate on its usefulness, its interests, and its dignity, without making its impress upon the great heart of society.

The ruling character of the nineteenth century is the tendency to per-

fecting the physical, intellectual, and moral welfare of man. In every civilized and progressive country, sciences, arts, private and general industry,—everything, in fact,—tends toward this end. Every one is carried forward by this general movement of advance, men as well as governments. And what are the obligations of organized government to its citizens concerning the security of the public health?

It would be easy to present examples from the history of republics, which have risen and passed away in distant lands and in distant ages, in proof of the endemic agency of bad government, and as a warning to the rulers of our own dear land, where a new social experiment is in progress,—the fairest, the freest, the most hopeful of any upon which the sun has diffused his life-giving radiance. And what are the elements of this beauty, this freedom, this bright anticipation? The answer is, Our own hallowed institutions; and another and far more important question should immediately follow, How shall they be preserved?

Hygeia has been called the handmaid of liberty;—and in illustration of this position historic examples could be furnished, pointing out the diminished population, decay of agriculture and commerce, and increase and fatality of diseases, which ensued on the downfall of republics. Knowledge of changes of this nature, which followed the destruction of the republics of Etruria and Magna Græcia by Rome, and then noting those manifested when the latter abandoned the republican for the imperial and despotic government, should be embraced in the common school education of every boy and girl in the United States. In subsequent times, what a contrast between the face of the country, as described by Muratori, when it had been overrun by the barbarians of the north, with that in a later age, when Christian civilization and liberty gave impetus to agriculture and commerce by imparting comparative security to the people who embarked in such industry and advancement. The region now called Turkey in Europe, Greece, and Asia Minor, exhibits silent but indubitable testimony in support of the same argument.

In these days of political struggle and divers interests, we hear much of the various means for the advancement and protection of the agricultural, the manufacturing, the mercantile, and many others of less extent and importance, including so-called vested rights. Each of these interests is made the theme for animated discussion and sharp contest by opposing political parties at the hustings, and thence become irrepressible questions for deliberation and decision by legislative assemblies, both state and national; and correctly so, for where the interests of the people are largely involved it is manifestly the duty of government to foster and protect them, and, when they are opposed to each other, so to regulate them on principles of justice as shall conduce to the general welfare and happiness. But what question of a mere business interest can compare, either in importance or extent, with the general and individual interest which every man has in the preservation of health and life? No matter what the labor, manual or intellectual, at which he is engaged, nor how productive, each and every mode of obtaining individual sup-

plies and contributing to the social welfare of the community is and must ever be subordinate, both individually and generally, to the possession of health. Accepting the estimate made by statisticians of the financial value of the life of each able-bodied, industrious man at sixteen hundred dollars, and the average cash value of each man, woman, and adolescent above twelve years of age at one thousand dollars, we then have some conception of the financial value of the life of each citizen, and the loss to the wealth of the country in unproductive labor, from sickness and death from preventable diseases.

It needs, therefore, no labored argument to prove that it should be the first duty of the government, both state and national, to protect the public health by legal statutes, based upon the knowledge that sanitarians have gained by their self-sacrificing and humane industries, and sown broadcast without price among the people, and to see that all the members of society are benefited by it. Indeed, every measure which relates to the improvement of the sanitary condition of the people generally, deserves the earnest attention of statesmen, and the favor and hearty support of the national government. Truly, sanitary science investigates the wants of humanity, and holds within its broad scope society in general. Human vicissitudes meet it at all times and places, and everywhere they find it prepared to give succor equal to the present emergency.

Statistical researches have discovered two extremely important facts, namely, that the mean duration of human life is generally less than the threescore years and ten commonly allotted as the term of man's existence, but that, on the other hand, communities have it in their power to diminish the causes which produce sickness and premature death ; and it has been made evident that in consequence of the wise employment of that power during the last century, the average duration of human life is slowly but progressively on the increase.

A comparison of the wise and liberal provision made by some of the European powers for the promotion of sanitary science, and for enforcing its life-saving and wealth-producing precepts among all classes of the people, with the spasmodic, unreliable, and inefficient legislation on the same subject in this rich and great country of ours, is, to say the least, not flattering to our national pride. Yet withal it must be acknowledged that the national legislature is liberal in many matters. In the exercise of its supreme authority on land or sea, it is not only utilitarian, but really scientific, and very sympathetic. Unfortunately, however, protection of the citizen from preventable diseases, which destroy thousands of lives annually, the cash value of which amounts to millions, seems to be no part of the national care or responsibility.

From the agricultural department the commissioner may send our distinguished fellow, Dr. Salmon, into any part of the United States, to investigate an outbreak of disease among horses, cattle, sheep, and hogs, chickens, geese, and ducks, if there should be no demurrer of states' rights, and he may order an inquiry to be made concerning the blight of the crops,—the potato-rot, for example,—and the best method of housing

and making healthy and productive honey-bees; but what special, well organized national department have we which is charged with the humane duty of investigating the causes of diseases among men, women, and children?

The national government has been thoughtful and liberal in establishing a department of education, and the commissioner, General Eaton, has so wisely and admirably directed the interests committed to his care, that, hand in hand with state superintendents of the public school system, under his leadership the whole nation has been thoroughly awakened to the importance of the mental culture of the citizen, but, unfortunately, at the same time greatly to the neglect of his physical culture, without attention to which there can be neither longevity and improvement of race, nor stability of government. In other words, the intellectual life, not the absolute life, is the subject of national concern.

There have also been provided a department of justice, a civil service, and a secret service, also many other agencies for the enforcement of law and order in society. Even the fisheries, the fish hatcheries, and the young seals of Alaska must needs have their agents, and are thus vouchsafed national protection; but the defenceless innocents, intended by nature to be the citizens of the next generation, may be killed by hundreds of thousands annually from preventable diseases,—small-pox, scarlet fever, diphtheria, typhoid fever, measles, cerebro-spinal meningitis, etc.,—and the slaughter is wickedly charged to the will of Divine Providence! The passage from infancy to childhood, and from childhood to adolescence, is a thousandfold more dangerous than the approach to our harbors; but no central effort is made to save the children from death before they reach their fifth anniversary in the voyage of life. During the present year an appropriation of over two millions of dollars ($2,368,102) was made for the establishment and maintenance of lighthouses, fog signals, and other like means to warn and guide the mariner; and should shipwreck nevertheless overtake him, nearly another million ($926,900) has been provided to aid in his escape from imminent peril, by keeping np the service of the life-saving stations.

In the same spirit the signal corps was supplied with $862,580 for its support. It is a valuable service, and well repays to the country the money expended upon it. So long, however, as the object of this weather bureau, which had its origin in sanitary science, embodied merely an effort to protect the citizen from disease, no money was voted to prosecute the needful inquiries; but as soon as it was suggested that warnings might be given of approaching storms, and property both on land and at sea be thereby protected, money was appropriated by millions to aid, and, so far as possible, perfect that service.

To the same object may be ascribed the munificence of the government in giving millions of money for the work of the coast and geodetic surveys, and for the work of the engineers in enlarging the channels to our harbors and improving our interior water-ways. And thus it seems it is less the life than the property of the citizen that is the object of care,

for we have seen that where property is concerned the national legislature is always appreciative and liberal. It is only when we come to ask for help to combat the preventable diseases constantly present among the people, and save thousands of valuable lives, that the minds of the national guardians become indifferent and unappreciative.

The liberality in aid of Arctic relief expeditions, and for observations on the transit of Venus, is in striking contrast with the legislation on the subject of the public health. In the budget of appropriations for the present year, $146,500 are given to the National Museum, $24,500 for the Howard University, $49,900 for the Freedman's Hospital and Asylum, $242,138 for the Hospital for the Insane, $72,000 for the Columbia Institute for the Deaf and Dumb, and, as final aid to the World's Industrial and Cotton Exposition, $335,000; but how much for the protection of the health and lives of the people? It is true temporary provision has been made to protect the country at large against the exotics, cholera and yellow fever, but it is the enemies we have always with us—pulmonary consumption, typhoid fever, scarlet fever, diphtheria, and other well known diseases that produce the greatest destruction of human life, and swell the total of the general distress in all parts of the country, and to combat which no national provision has been made.

Besides all this surveillance of divers interests, and the supply of millions of money to support them, how many square miles of the national domain have been given away in railroad subsidies, under the plea, no doubt, that the end justified the means? Yet these acts of a liberal and progressive government constitute, probably, not the one hundredth part of the sum total of appropriations of money, for purposes of far less importance than the interests of the public health.

It may be said that protection from the common diseases of the country is a matter that belongs to the state, the municipality; but it belongs to the national government as well, at least, with equal reason for the establishment and maintenance of a central bureau of education and a department of justice, that much more can be effected by national work and coöperation than by a series of independent and incoördinated local efforts. But I pray you not to believe that I think the departments of agriculture, education, and justice have received undue support and encouragement. Very far from such opinion,—so far, indeed, that I should be glad to see increased facilities given to the agricultural department for the study of the diseases of our domesticated and food-producing animals; also, greater latitude of authority and more money given to the department of education. My object in directing your attention to them is simply to show that the interests of the public health have not received a corresponding and sufficient share of national aid and encouragement. The National Board of Health, which a few years ago was a live power and a strong arm in protecting the public health, has been so handicapped and crippled by inadequate appropriations of money for its support, that it has lately been incapable of performing the important service for which it was created, and for that reason has now but a nominal existence.

The Marine Hospital Service has been greatly favored, and, having been thus encouraged, its authority has been industriously directed by the supervising surgeon, Dr. Hamilton. Indeed, he has done his work so well, that there is danger, I think, of overloading him with extra official duties and responsibilities, such as the control of coast quarantine and sanitary inspection, with their complex entanglements, national and inter-state—duties which were not embraced "in the bond" establishing that service.

But, however active and efficient this valuable service may have become under the administration of its able director, Dr. Hamilton, it is not proportioned to meet the need of a permanent and well supported national health bureau, which humanity, the spirit of the age, and the progress of sanitary science in this country demand shall be established, either as an independent branch of the public service, or in connection with the departments of agriculture and education. Without such national recognition and liberal support, it is impossible to bring sanitation in this country up to the level of its rapid advancement in Europe; and surely this great government of ours ought not to be behind the sister governments in such good work.

We are to-day at the very threshold of great possibilities in preventive medicine, and the central government should foster every effort for the success of the work in which sanitarians are so heartily engaged. To aid them in the study of contagious or infectious diseases, both among human beings and animals, and the blights upon the crops, a national biological laboratory should be provided; and no other place would be so well suited for the location of such a school of science as the new building now in process of erection for the Army Medical Museum and Library. With a thoroughly equipped national school of biology, our scientists would not then have to visit the laboratories abroad,—to Pasteur in Paris, Klein in London, and Koch in Berlin; neither should we then see our own distinguished Steinberg quartered at the Johns Hopkins University in Baltimore for favorable facilities for the study of micro-organisms in relation to diseases.

Biology owes its existence to microscopy, and under its searching penetration the whole field of the practice of medicine has been revolutionized, and placed upon more rational foundation. Without the aid of microscopical investigations sanitary science could have made less substantial progress, and mere conjecture would still be the only answer to many of its important problems. Hence, to be a sanitarian in the full sense of the name means familiarity with microscopical technology, and the ways by which the great possibilities of to-day in science have been reached. Verily, what a speedy march to triumph in the field of preventive medicine, if every board of health, every health officer, every practising physician, were familiar with and employed the microscope in the study of the natural history of diseases! What is wanted is a unification of scientific sanitary work. A civilization based on science is ever progressive, and if our hopes for a glorious future are based on scientific research, they are indeed well founded.

I hope you will take advantage of the opportunity afforded by this meeting to urge upon congress, now in session, the necessity of legislation in the interests of the public health and scientific sanitary work. Your presence in such large numbers, having come up hither from your far-off homes, quit your business of bread-winning for the time, and emptied your pockets of many hard earned dollars in payment of necessary expenses of the journey to this meeting, is sufficient proof of your earnest, self-sacrificing labors in the vineyard of sanitary science, and will, I trust, influence the national legislature to establish, on a broad and firm basis, a health bureau which shall prove a blessing to the whole country.

The pestilence—Asiatic cholera—which has swept off so many thousands of human lives in Europe during the last two years, threatens this country, and, like the awful sword suspended over the head of Damocles, may fall at any moment upon our people, and turn the whole nation into mourning. We can scarcely hope to escape next year the presence and terrors of the merciless visitor whose line of march wherever recorded has been strewn with the dead bodies of its multitude of victims. Are our houses in order for the coming of the unwelcome guest? If not yet, further precious time should not be wasted. In all places the alarm should be repeated, and the command given, "Be ye also ready!"

This meeting will be specially memorable because it begins a new series of volumes of the transactions of the association. The work done in the past, and recorded in the first series of ten handsome volumes, speaks for itself. In none of the great libraries in this country can there be found a system of sanitary literature of greater variety and value than in these volumes. In order that their compass and value may not escape your attention, I have run over them to make the following condensed statement of their contents:

Volume I—563 pages—contains 48 papers by 44 authors.
Volume II—552 pages—43 papers by 39 authors.
Volume III—241 pages—29 papers by 29 authors.
Volume IV—396 pages—37 papers by 33 authors.
Volume V—256 pages—20 papers by 19 authors.
Volume VI—497 pages—36 papers by 36 authors.
Volume VII—446 pages—33 papers by 30 authors.
Volume VIII—359 pages—21 papers by 20 authors.
Volume IX—453 pages—26 papers by 26 authors.
Volume X—536 pages—46 papers by 43 authors.

A total of 339 different papers by 222 authors, not including 12 presidential addresses, and many verbatim reports of interesting discussions of important questions.

Several of the earlier volumes have already become so scarce in the office of the association, that the treasurer, Dr. Lindsley, has been lately a purchaser of these issues as opportunity presented, in order to enable him to furnish complete sets. Very soon the first three volumes cannot be supplied at any price; and the question may now be raised, How shall

the break of the set be remedied? The issue of a second edition would be next to impossible, and the only way, I think, to meet the situation would be the publication of a compendium, in one volume, of all the papers contained in the ten volumes. I submit this question for your consideration, and should it receive favor, you will, I am sure, have no difficulty in finding "the right man in the right place," as editor of the volume.

Our energies have been greatly encouraged during the past year by the munificence of Capt. Henry Lomb, a citizen of Rochester, N. Y., whose large-heartedness of sympathy and pure love of humanity induced him to offer, at the St. Louis meeting last year, $2,800 in prizes, to be awarded at this meeting, for the best essays on the four subjects selected for competitive study and report. This noble example of Capt. Lomb, it is to be hoped, will from time to time be followed by other persons of like liberality, and who believe, with him, that the cultivation of sanitary science is the way to the highest citizenship and a life of moral purity. The Lomb prize essays will therefore be a special feature of this meeting. How to place them in the hands of the people, and carry out the wish of the generous donor, is a question of great importance, and should receive attention and be disposed of at this meeting of the association.

Of not less importance to the association and the general public will be the report of the special committee on disinfectants; and if the character and value of the complete or final paper may be anticipated and measured by the preliminary reports which have been made by individual members of that committee, and published in the *Medical News*, Philadelphia, it will prove one of the most valuable contributions ever made to the transactions of the association. No such painstaking labor in this field of research was ever before undertaken in this country; and I predict for it not only the attention, but also the thanks, of all English-speaking sanitarians. These papers will make the next volume of transactions a book of unusual interest and value.

And now a few words to my fair hearers who have honored us by their presence, and I am done. The goddess Hygeia, your patron saint, will accept of her admirers and votaries no mere lip-service,—nothing less, indeed, than supreme devotion to her charms. The cause of sanitary science presents a strong claim upon your sympathies and affections, because its saving influence brings to the lying-in room, the nursery, the family circle, even to extreme old age, the beauty of health and the fulfilment of domestic happiness.

The elevation of woman, the just appreciation of female excellence, has ever continued to keep pace with the advance of literature and science. Look at her condition among the savage tribes, cultivating the field, or carrying home the bleeding victim of the chase, driven before her barbarian lord. Look at her condition among the semi-barbarous or half-civilized nations, shut up in harems and seraglios, cut off from the enjoyment of society, and denied the invigorating influences of pure air and God's own beautiful sunlight. But, behold! as science advances, she

gradually acquires her true position in the scale of social life, the object of universal regard, the inimitable type of the artist's skill, the theme of the poet's happiest inspirations.

I will not ask you, ladies, to approve, because I know you will approve and applaud, the labors which are poured as votive offerings at the shrine of your loveliness.

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14. HEREFORD, Rev. Dr.
 16. Public Holidays and Public Health.
15. HERRICK, S. S., M. D.
 17. Propositions relative to the Etiology of Yellow Fever.
16. HEWITT, CHARLES N., M. D.
 18. The Work of Hygiene in the Education of Children in the Common Schools, and in the Families and Society in which they Live.

17. Hitchcock, Prof. Edward.
    19. Hygiene at Amherst College.
18. Holliday, D. C., M. D.
    20. Is Efficient Quarantine Possible or Practicable?
19. Hunt, Ezra M., M. D.
    21. How to Study an Epidemic.
    22. The Prophylactic Treatment of Individuals as a Means of Preventing Epidemics of Yellow Fever, or other Infective Diseases.
20. Jennings, R. G., M. D.
    23. The Quarantine at Little Rock, Ark., during August, September, and October, 1878, against the Yellow Fever Epidemic in Memphis and the Mississippi Valley.
21. Le Conte, John L., M. D.
    24. Sanitary Problems: the Proper and Rational Method in which Municipal Boards of Health should be Organized.
22. Lindsley, J. B., M. D.
    25. Report on the Yellow Fever in Nashville, Tenn., September and October, 1878.
23. Lyman, Henry M., M. D.
    26. A Review of the Present State of Exact Knowledge regarding the Causation of Epidemic Infectious Diseases.
24. Morris, John, M. D.
    27. History of the Epidemic in Baltimore in 1876.
25. McClellan, Ely, M. D.
    28. A Study of the Yellow Fever Epidemic of 1876, as it affected the State of Georgia.
26. Plunket, J. D., M. D.
    29. Disinfection of Sewers by Ozone.
27. Rauch, John H., M. D.
    30. The Sanitary Problems of Chicago.
28. Selden, William, M. D.
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29. Smart, Charles, M. D.
    32. Abstract of a Report on the Spring, Well, and River Waters in the Department of the Platte, made to the Medical Director U. S. Army, under date of May 26, 1876.
    33. Abstract of a Report on Certain Points in Medical Climatology.
30. Steiner, Lewis H., M. D.
    34. An Address on the Objects of the Association, and its Claims upon the People for Sympathy and Support.
31. Taylor, J. Howard, M. D.
    35. Memorandum concerning the Refugee Cases of Yellow Fever in Philadelphia, 1878.
32. Turner, T. J., A. M., M. D., Ph. D.
    36. Air and Moisture on Shipboard: a Fragment of Applied Physiology.
33. Vandeman, J. H., M. D.
    37. Yellow Fever as it Existed in Chattanooga, Tenn.—Its Origin, Progress, and the Probable Remedy for its Abatement in the Future, including one Report of Delegation.

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1. Brewer, Prof. W. H.
    1. On Rotting Wood.
2. Cameron, Col. John F.
    2. Camps—Depopulation of Memphis—Epidemics, 1878 and 1879.

3. CAMPBELL, HENRY F., M. D.
   3. The Yellow Fever Quarantine of the Future, as Organized upon the Portability of Atmospheric Germs, and upon the Non-Contagiousness of the Disease.
4. CHANDLER, J., M. D.
   4. How to Deal with a First Case and Early Cases of Yellow Fever, when, in spite of Precautions, it has made its Appearance.
5. CLARKE, ELIOT C., C. E.
   5. City Scavengering in Boston.
6. COMPTON, J. W., M. D.
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8. GIHON, ALBERT L., M. D.
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11. JENNINGS, R. G., M. D.
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12. MUNROE, Prof. CHARLES E., U. S. N. A.
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14. SMITH, STEPHEN, M. D.
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16. THORNTON, G. B., M. D.
    17. Yellow Fever Epidemic in Memphis, 1879.
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    18. Etiology of Yellow Fever, with Remarks on Quarantine.
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36. Wight, O. W., M. D.
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1. Adams, J. F. A., M. D.
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9. Fenner, Edward, Esq.
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29. WHITE, C. B., M. D.
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30. WRIGHT, A. R., M. D.
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    2. Sanitary Inspection.
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6. COGGSHALL, BELA, M. D.
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11. KEATING, Col. J. M.
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13. NEWELL, T., M. D.
    14. The Sanitary, Physical, and Educational Advantages of Interior Open-air Areas in Large Cities.
14. SMITH, JOSEPH R., M. D.
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16. STEVENS, THAD. M., M. D.
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17. STORER, HORATIO R., M. D.
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18. THORNTON, G. B., M. D.
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20. WILSON, T. P., M. D.
    21. Life on Wheels—Its Sanitary Needs.

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1. BELFIELD, WILLIAM T., M. D.
    1. Swell-Head in Cattle.
2. DEWOLF, O. C., M. D.
    2. Pullman from a State Medicine Point of View.
3. FERGUSON, DAVID, M. D.
    3. Preventable Contagious Diseases.
4. FOSTER, EUGENE, M. D.
    4. Report of the Committee on Compulsory Vaccination; also a Supplementary Report on the Efficiency and Safety of Vaccination.
5. GIHON, ALBERT L., M. D.
    5. Vital Statistics as Sanitary Monitors.
6. HARGIS, R. B. S., M. D.
    6. The Pensacola Yellow Fever Epidemic of 1882.
7. HERING, RUDOLPH, C. E.
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8. JANES, E. H., M. D.
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9. LEEDS, Prof. ALBERT R., Ph. D.
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10. LUNDY, CHARLES J., A. M., M. D.
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13. PARTRIDGE, J. M., A. M., M. D.
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14. Penn, J. W., M. D.
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15. Pratt, Foster, M. D.
    15. The Increase of Insanity in the United States: its Causes and its Sources.
16. Raymond, Joseph H., M. D.
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17. Reeves, James E., M. D.
    17. The Eminent Domain of Sanitary Science, and the Usefulness of State Boards of Health in Guarding the Public Welfare.
18. Salmon, D. E., D. V. M.
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19. Sargent, Prof. D. A.
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21. Smith, Joseph R., M. D.
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22. Sternberg, George M., M. D.
    22. Malaria.
23. Watson, Prof. J. Madison.
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24. Webb, R. D., M. D.
    24. The Changes of Type which Malarial Fevers have Undergone in Sumter County, Ala., from 1833 to 1883.
25. Wood, Thomas F.
    25. The Clinical Thermometer in the Prevention of Malarial (Paludal) Fever, especially that Form of it to which Seamen sailing out of South Atlantic and Gulf Ports are Liable.
26. Woodhull, A. A., M. D.
    26. The Etiological Association of Organic Matter with Malaria.

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1. Alt, Adolf, M. D.
    1. On Protective Spectacles for Workingmen.
2. Baker, Henry B., M. D.
    2. The Relation of the Depth of Water in Wells to the Causation of Typhoid Fever.
3. Beugless, John D., Chaplain U. S. A.
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4. Brewer, Prof. W. H.
    4. Glucose in its Sanitary Aspects.
5. Brooks, Hon. Erastus.
    5. The Food we eat, the Liquids we drink, and the Adulterations we submit to.
6. Chancellor, C. W., M. D.
    6. The Squalid Dwellings of the Poor—a Social and Sanitary Reproach.
7. Conery, W. B., M. D.
    7. Sanitary Care in Stock Transportation in the Prevention and Control of Texas Cattle Fever.
8. Cook, W. C., M. D.
    8. Public Health and Legislation.
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10. Curtman, Charles O., M. D.
    10. On Heating and Ventilation of Dwellings and School-Rooms.

11. DAVENPORT, BENNETT F., M. D.
    11. Adulterations of Food and Drugs.
12. ELDER, E. S., M. D.
    12. Sanitary Survey of the School-Houses in Indiana.
13. FORMENTO, FELIX, M. D.
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14. FRY, FRANK R., A. M., M. D.
    14. The Manufacturer of Soda-Water from Polluted Well-Water.
15. HARRIS, W. JOHN, M. D.
    15. The Chemical Disposition of Sewage.
16. HARTWELL, EDWARD MUSSEY, M. D., Ph. D.
    16. On Physical Training in the United States.
17. HERRICK, S. S., M. D.
    17. The Relation between Underground Sewerage and Filth Diseases.
18. HOMAN, GEORGE, M. D.
    18. A Sanitary Survey of St. Louis ; being a Series of Short Papers on Leading Public Health Topics, contributed by City Officials and Local Sanitarians.
    19. The Situation, Surroundings, and Soil of St. Louis. Considered from a Hygienic Standpoint.
    20. The Leading Local Productive Industries, and their Effect on the Health and Lives of their Operatives.
19. KEATING, J. M.
    21. The Ultimate of Sanitation by Fire.
20. LUEDEKING, ROBERT, M. D.
    22. The Chief Local Factors in the Causation of Disease and Death.
21. MOORE, ROBERT, C. E.
    23. Sewerage and House Drainage in St. Louis.
    24. Notes upon the History of Cholera in St. Louis.
22. MORRIS, J. CHESTON, M. D.
    25. The Milk-Supply of our Large Cities—The Extent of Adulteration and its Consequences—Methods of Prevention.
23. MUNROE, Prof. CHARLES E., U. S. N. A.
    26. The Use of Cotton-Seed Oil as Food and for Medicinal Purposes.
24. NEWTON, WILLIAM K., M. D.
    27. The Sanitary Survey of a House.
25. NIPHER, Prof. F. E.
    28. The Mean Temperature and Climatic Conditions of St. Louis.
26. PARKER, W. THORNTON, M. D.
    29. The Sanitary Management of Railway Cars and Stations.
27. PARTRIDGE, J. M., A. M., M. D.
    30. Protection against Hydrophobia.
28. REEVES, JAMES E., M. D.
    31. Pollution of the Upper Ohio, and the Water-Supply of the Cities and Chief Towns within the first Five Hundred Miles of its Course.
29. RICHEY, S. O., M. D.
    32. Deterioration of Vision in School Children.
30. ROBINSON, Major SAMUEL A.
    33. Hygiene of the Habitations of the Poor.
31. ROHÉ, GEORGE H., M. D.
    34. The Hygiene of Occupations.
32. SMART, CHARLES, M. D.
    35. On the Present and Future of Sanitary Water Analysis.
33. SPIEGELHALTER, JOSEPH, M. D.
    36. The Local Milk-Supply—Its Sources and Quality.
34. STERNBERG, GEORGE M., M. D.
    37. Disease Germs.

35. STEVENS, THAD. M., M. D.
   38. The True Value of Chemical Analysis in Determining the Hygienic Purity of Potable Water.
36. STEVENSON, JOHN D., Esq.
   39. Organization of Health Department, Sanitary Legislation, and the Abatement of Nuisances.
37. THORNTON, G. B., M. D.
   40. Sanitation of the Mississippi Valley.
38. TURNER, JOHN W., C. E.
   41. Street and Alley Paving in St. Louis.
39. VAUGHAN, V. C., M. D.
   42. Poisonous or "Sick" Cheese.
40. VINNEDGE, W. W., M. D.
   43. On the Duration of Infectiousness in Scarlet Fever.
41. WARING, GEORGE E., Jr., C. E.
   44. The Disposal of Sewage.
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43. WYMAN, W., M. D.
   46. Hardships of the Coasting Trade, and Particularly of the Chesapeake Bay Oystermen.

Total number of different authors, ... 222
*Total number of papers contributed, ... 335

* The Reports of Committees and Delegations, four in number, in the above list, are not included in this total.

II.

ADDRESS OF WELCOME.

By Hon. J. B. EDMONDS, President of the Board of Commissioners of the District of Columbia.

Mr. President and Gentlemen of the American Public Health Association :—I come on behalf of the citizens of the District of Columbia, as well as the local government, to say that they extend to you a cordial welcome. They welcome you not only as eminent citizens of your country and worthy representatives of the great republic of science, but also for the cause that brings you together, and to which you have given many years of service. I know of no grander moral spectacle than such an association of gentlemen, coming from all parts of the continent, well qualified for this work, prompted solely by a love of science and a spirit of kindness, freely devoting their time and money to the study and solution, for the people, of those great problems that so often involve the health and life, or the disease and untimely death, of thousands. [Applause.]

I know of no labor so urgently demanded of science and benevolence; none better entitled to the active coöperation of all society; none that would better promote civilization, or more happily express the enlightenment of the age in which we live.

In former ages, the three greatest enemies to national welfare and happiness seem to have been war, pestilence, and famine; and, until the present century, all these were regarded as beyond the realm and reach of human science, and were accepted as the mysterious scourges of Providence, whereby nations were chastised for their sins. During the present century, however, the genius of man has so wrought upon steam, upon electricity, and other forces of nature, that not only have the products of the earth been vastly increased, but, by means of rapid communication, all nations have been brought into close relations, one easily supplying what another lacks, and thus national famines have disappeared from the world, together with the ignorance that tolerated them. [Applause.]

Your association suggests that it is now time to enter upon another stage of civilization. You boldly avow that man should no longer cringe and cower before pestilence, nor flee its approach, as from some irresistible, devouring demon, but rather that he should turn upon it and wage a war of subjugation, in which you, gentlemen, have already enlisted as volunteers, and have raised the standard of man's emancipation. [Applause.]

You insist that disease and pestilence are not rightfully the masters of

man, and that they tyrannize over him only because of his ignorance or cowardice. You say that they themselves are merely the humble subjects of Nature, and come and go only in obedience to her laws, as the waters rush from the mountains and devastate the plains below only until the genius of man shall provide safe conduits, and control their course. You have a theory with regard to pestilence like that first propounded by Franklin with regard to lightning,—that by proper precaution it can be rendered harmless. Lightning, through all ages, had been a terror to mankind, until it occurred to that philosopher that it might be received upon a metallic point, and conducted safely into the ground. So Asiatic cholera, subtle as lightning and terrible as war, that has periodically visited Europe from its earliest history and counted its victims by the million, may, as you believe, together with yellow fever and other destroying epidemics, be received, not, indeed, like lightning, on metallic points, but at quarantines established along the coast, where by proper treatment they may be destroyed, or safely conducted away; or, should they insidiously reach the interior, that every city, village, and hamlet may be so defended that the baffled monsters must pass harmless by. [Applause.] I have implicit faith that victory will ultimately crown your efforts. The logic of science declares in your favor, and every consideration of humanity urges you onward.

I need not tell gentlemen of your experience and wisdom that there may be temporary failures or long delays, for, as we all know, the laws of Nature are not easily read, and she sometimes yields her profounder mysteries only to the third or fourth generation of them that serve her. Nor can we forget that your contest is with a veteran foe. Disease, that hateful and miscreant offspring of violated law, is as old as the human race. It sits unbidden at our tables; it lies in our beds; it robs us of many pleasures, and often destroys our dearest friends. Yet so multiform and subtle is its nature, that none can seize upon it or tell us precisely what it is; and those who have battled against it longest are compelled to admit that their success thus far is only partial, and that many a stronghold of the enemy is still to be taken.

Yet ground has been gained in this contest, and I think there is every reason for encouragement. And never was battle waged in better cause or for grander results. Your war is not to kill, but to preserve life; and as it is for the benefit of all mankind, you are entitled to a corresponding support. You are entitled to the appropriate legislation [applause]; entitled, if need be, to levy contribution upon every science, art, and industry. You are entitled to a cordial welcome, the warm sympathy, and the earnest coöperation of every municipality in the land; and nowhere, as I believe, will these be more cheerfully accorded than here at the national capital. [Applause.]

III.

ADDRESS OF WELCOME.

By J. M. TONER, M. D., Washington, D. C.

Mr. President and Members of the American Public Health Association :—The committee of arrangements for your meeting this year have assigned me to the pleasant duty of welcoming your association to the city of Washington. But I fear, that however appreciative I may be of the importance of the work in which you are engaged, I lack the ability to fully voice the sincere and hearty sentiments of good-will which the medical profession, and all laborers in the sciences which have for their aims the advancement and good of the human race, residing in Washington, would have me utter as their congratulations and best wishes for the furtherance of the purposes of this association.

It is believed that you, and every intelligent citizen of the several states and territories of the United States, feel a pride in the city which bears the name of the Father of the Republic.

We trust the city of Washington deserves, and may always enjoy, the consideration and esteem of sanitarians. Here are stored or being steadily collected, in grand and capacious fire-proof buildings, the precious literary treasures of the history of America, and here the grandest museums of the arts and sciences of a free people are rapidly centering. Here, too, are the homes of the officers selected by the suffrage of the sovereign people of the United States as their chosen agents to administer the national government.

Coming as you do from every part of our country from which this city is populated and derives its importance, it is but just that you should recognize the fact that you and your people have here vested interests, not only in the beauty of the city and the grandeur of the public buildings, but in their hygienic completeness, and in everything which tends to render the city of Washington worthy of the homes of your representatives, and to be the capital of the nation.

Your coming has been heralded to the country by the press, and the labor in which you are engaged is known as current news to the legislative, judicial, and executive departments, as well as to the professional man, the scientist, and the citizens of Washington.

All know the beneficent aims of your association, and the great value of your recommendations to public health authorities, and look hopefully to the benefits which cities, towns, hamlets, and rural homes throughout the land may derive from a thorough and impartial consideration by you of the many and complex questions of sanitary science.

The programme of subjects arranged for discussion, and the titles of papers to be read at this meeting, show that the members during the

year have given much thought to public health questions. Identified as most of you are with the administration of sanitary regulations in cities, your discussions are naturally devoted to subjects of the first practical importance to the public.

A great desideratum of all health regulations, and particularly city sanitation, is to obtain prompt and satisfactory results with the least cost and inconvenience to the people. Your experience, as well as your expert knowledge, gives your recommendations the weight of law on all such matters.

Although personally more familar with the historical and theoretical side of sanitary questions than with the practical, I am impressed by a survey of what I know formerly obtained, and what are now the methods of sanitary supervision in our cities; and I am greatly encouraged by the progress which has been made for the better during the thirteen years of the existence of this association. The legislatures of the states and the councils of cities are now willing to be advised by competent sanitarians as to the causes of disease, and the adoption of necessary means for their removal or prevention. At this day there is scarcely a state or city without a regularly organized board of health. Such was not the case when this association was formed.

It is not to be expected that legislators can go much in advance of the views entertained by the mass of the people in the value of protective measures, and it is just as true that both will be somewhat behind the most thorough sanitarians. We must, therefore, be patient but untiring in our efforts to educate and encourage the more intelligent and thoughtful to adopt, about their homes and in their daily life, hygienic precautions. Their example in these matters will in time extend, by imitation and habit, to those less favored by fortune. A knowledge of the laws of health does not come to a man by intuition, but by education and experience.

The national government has in various ways, of late, shown itself a friend and supporter of measures for the protection of the public health. This has been especially manifested in the creation of the National Board of Health, the bringing about of the International Sanitary Conference in Washington in 1882, and the appointment of the several commissions to investigate cholera and yellow fever; and while the reports on these topics have not thus far been conclusive, still they have served to educate the profession and the public in the right direction, and have increased our knowledge of the most efficient methods of quarantine, and the use of the most potential antiseptics and disinfectants. We have the faith to hope that scientific observers will yet unlock the secrets which are now hidden from our vision as to the origin of these and other epidemics, and devise means for their control. Who would be rash enough to assign a limit to what the investigations now in progress in this direction may accomplish? Pasteur, Koch, Sternberg, Shakspeare, and a host of other well trained and acute scientific observers, are carefully studying what relation certain micro-organisms, present in if not the cause of these dis-

eases, bear to them. What has already been discovered in this direction justifies a hope for further success.

The passage by congress of the law of 1878, for the establishment of inspection and efficient quarantine to prevent the introduction, by land or sea, of infectious and contagious diseases from foreign countries, has been a most important step in the direction of wise sanitary precautions; and its administration has, on more than one occasion, saved the country from the invasion of a serious epidemic.

Perhaps the most difficult part of the work of improving sanitary matters in America has been already accomplished,—that is, of getting the people to recognize the fact that filthiness is always dangerous, and of gaining, as our aids in preventing nuisances, the public press of the country. At the present day, things notoriously injurious to health are detected by the news-gatherer and commented upon in the daily papers; and neglected or untidy streets, alleys, and premises, the precursor of nuisances which in times past would have gone unnoticed even by health officers, are now certain to be complained of and promptly remedied. These vigilant and influential voluntary inspectors are powerful agents for good, and I am confident they are on the increase, and render any backward steps impossible.

A steady improvement in domestic hygiene and municipal sanitation throughout the United States is, I think, apparent to the most casual observer. Legislative bodies, national and state, as well as cities, will, in their respective spheres, hereafter more promptly authorize and enforce well digested means for the protection of the public. If I am not over-hopeful in this matter of improved sanitary measures and practices among the people, and their desire to coöperate with health authorities in the lessening of preventable diseases, I think you have great reason to be encouraged.

In conclusion, I would again recur to the fact that you are recognized as veterans in the art and science of preventive medicine. You are not strangers to our people, and not only the medical profession, but also the citizens of Washington, desire that you should feel that you are at home here. Your mission is eminently humane, and world-wide in its beneficence. This is the nation's common ground. It is particularly fitting that organizations of a national character should meet in the national capital. This must, if it has not already, become the favorite city for all conventions having an interstate membership. Many such have assembled here in the past; and as yours includes Canada, it is international, and is but a precursor of, though in no wise connected with, the great International Medical Congress which is to meet in the city of Washington in 1887. Here you require no official declaration to enjoy the freedom of this city. That is your birthright—the inheritance of every American citizen. During your sessions here, command us, of the Committee of Arrangements, under our worthy chairman, Dr. Townshend, as you would members of your own household, in everything which may tend to make your meeting successful, and your visit one to be pleasantly remembered.

IV.

LETTER FROM PRESIDENT CLEVELAND.

EXECUTIVE MANSION, WASHINGTON, Dec. 7, 1885.

DR. J. M. TONER:—*My Dear Sir:* I am sorry that the condition of the public business is such I cannot accept the invitation which you kindly tendered me in behalf of the American Public Health Association to attend its annual meeting to-morrow evening. I beg to assure you that my expression of regrets is not merely formal, but actually indicates a sense of privation which attends inability to give, by my presence, as requested, the fullest endorsement of the object and purposes, as well as the work, of the association.

Surely "the advancement of sanitary science," and its practical application to the public health, are of immense importance to the people of our land. Of course, the value of efforts in the direction of a better understanding of the causes of disease, and protection against the same, is too palpable for suggestion or argument. But I do not think the advantages of an improvement in the condition and sanitary surroundings of the homes of our working-men, and of the poor among us, are sufficiently appreciated. Healthful and comfortable habitations indicate the best features of a country's prosperity and advancement; and men with good health and wholesome surroundings are apt to be contented and useful citizens.

The difference in the death-rate of cities and localities, unexplained by natural and inherent causes, is of itself enough to give great prominence to the work of the association; and if this beneficent organization shall succeed, as it ought, in impressing upon municipalities the duty of sensible and thorough sewerage, a plentiful and pure supply of water, and general cleanliness, together with a proper construction of school buildings for the children of these citizens, it may well point with pride to its achievement.

With the hope that the association may be the means of constantly increasing benefits to the country, and with expressions of heartiest sympathy with its work, I am

Yours sincerely,

GROVER CLEVELAND.

V.

SANITARY NOMENCLATURE.

By EZRA M. HUNT, M. D., Secretary of the State Board of Health of Trenton, N. J.

The nomenclature of any science or of any art is important, because correct analysis or statement is itself a process in knowledge, and because a use of terms that are similarly understood is essential to all scientific method and intelligent discussion. So much misconception comes from a loose or indefinite use of terms, that we cannot be too careful to have classifications which shall have right foundations, and be well understood. No two persons can discuss a subject of medical or sanitary science or art, without they use technical terms in the same sense, or without the one knows in what sense the other uses them. The need of this exactness in a new science or a new art is especially manifest. Variations and confusions which arise from such misunderstandings are common in the infancy of almost every new department.

A glance at the most common names in this department illustrates this. The word hygiene has a variety of spelling justified by the dictionaries, that could not have occurred had its derivation from the Greek, *Ἰγιαίνω*, "I am in good health," been kept in view. This alone should determine the spelling hygiene in preference to the form hygieine and hygeine, both of which have been in common use. The motto of the gold medal founded at Netley in memory of Edmund Alexander Parkes is this line of Isocrates: *Ἡ περι το σωμα χαιτην Φυχην Ἰγιεια.* While its use in the old mythology is well known, its first use in its present sense was, according to Littré, by the old surgeon, Ambrose Pare. It is better than the expression "medical police," which in France and Germany has so long been the general expression for sanitary care.

Hygiology is a good word, as used by Dr. Farr, to denote that science of which hygiene is the art. Hygiology (see Dr. Farr's Fifth Report) is the science of hygiene.

Our next word, sanitary, also has a good derivation from the Latin *sanis*. As to it, we find that in the first reports of the registrar-general of England the word was uniformly spelled sanitory. (See Fifth Report Registrar-General Farr, 1843.) Its changed spelling is probably made in order to conform to the usual terminology of such words in our language.

Besides the words hygiene, hygiology, sanitary, and sanitation, there was an early tendency to speak of sanitary medicine and of state medi-

cine. Although, if we could use the term "medicine" in what Professor de Chaumont claims to be its derivative sense,—namely, that of knowledge by measurement (Sanitary Legislation Conference, International Health Exhibition, 1881, p. 63),—it has now come to apply so strictly to medical science and practice, that it seems to us best, so far as possible, to dissociate it from the nomenclature of hygiene. For the same reason, we think the term "state medicine" should be supplanted by the term "state hygiene," which thus includes all the care of health which should be provided for by governmental enactment, whether national, state, or municipal.

The two next words that meet us oftenest in confusion are contagion and infection. Many efforts have been made by authors to separate the two; to confine contagion to those diseases which are derived by *contact*, and to use the word infection in respect of those diseases which are not caught by direct contact, but through media. But it is to be noted that to infect (*in facio*) is to put into or to stain, and that strictly it would denote disease introduced by contact, and so was formerly applied to the plague, to itch, syphilis, etc. (See Dunglison.) Its sense by use came to be, to taint with disease, or to infuse, whether mediately or through intermediate agency.

Contagion (*contango*), even in its original use in English, meant to touch, by contact direct or indirect, and so did not always denote actual contact. Webster says, notwithstanding efforts to separate infection and contagion, they are used as synonymous. Worcester, Bacon, and Dunglison use the words as synonymous, although the latter seeks to confine contagion to diseases resulting from close contact. Contagious and transmissible are often used as synonymous.

Wilson, one of our most exact writers on hygiene, says that by infection is meant all diseases which are communicable from one person to another, whether by actual contact, or through the agency of certain media, as air or water. Any one who will examine the various standard authorities, either on lexicography, epidemiology, practice of medicine, or hygiene, will soon perceive the want of uniformity of meaning and of distinction in use.

Neymeyer, under acute infectious diseases, has typhoid fever, smallpox, intermittent fever, and speaks also of the miasmatic origin of typhoid, cholera, trichinosis, glanders, and syphilis.

After examining the views of various good authorities, and the use of the terms as we find them, we are compelled to admit that there is no uniform distinction in their usage. So Dr. Mapother, in his lectures on public health, says,—"I will use the words contagious and infectious in no limited sense relating to touch or air alone, but as synonymous with communicable, or the familiar word catching."

This is the more to be excused, because we are not yet able to distinguish accurately between those diseases acquired only by contact and those acquired through media. Where either of these words is now used in the more general sense, the good English word *communicable* may

be well substituted. We see no reason why the words infection, infective, and infectious might not wholly cease to be used as designating, in general, communicable diseases.

There is another suggestion as to these words which is well worthy of thought. It is, that *infectious* be used only as the word for a class or order of disease, the same as we would use communicable or transmissible, and that groups or species be spoken of under it, such as contagious, miasmatic, contagio-miasmatic, miasmatic-contagious, inoculable, etc.

Contagious is thus used to designate such diseases as are only derived from the person, and so arise within the system, and have no other source of origin,—for example, measles.

Miasmatic (Gr. *μιασμα*, defilement) is used to denote those diseases which affect man, but which never have their origin within the system, as intermittent fever. Dr. Farr, quoting from Liebig (Fourth Report, 1842), says,—"Miasm, properly so called, causes disease without being itself reproduced." It is a disease-producing cause, arising outside of the body, but not communicable from the body.

Contagio-miasmatic diseases are those in which something is separated, as secretion or excretion from the body, which, on exposure to outside defilement or other influence, becomes disease-breeding. Such is typhoid fever. Miasmatic-contagious diseases are those in which the miasm being produced outside of the body, it is made operative by changes it undergoes in the body. This at present is a hypothetical division.

Of either of these classes of disease, such as are inoculable may be so specified, as well as those that are known to be parasitic. It is proper, also, to distinguish between the animal and vegetable parasitic diseases. For reasons which hereafter appear, the terms zoo-parasitic and phuto-parasitic are applicable. We would retain contagious, because it so relates to the person as the source of the disease, and miasmatic, because it stands for noxious exhalations or particles derived from outside sources.

The last English statistical nomenclature, instead of using miasmatic as a term for diseases arising from emanations and causing disease without being itself reproduced, uses it to denote what it calls "specific febrile diseases, or zymotics," and includes small-pox, measles, epidemic rose-rash, scarlet fever, typhus fever, relapsing fever, influenza, whooping-cough, mumps, diphtheria, cerebro-spinal fever, simple continued fever, and other miasmatic diseases. Surely there is no basis for an intelligent nomenclature in the use of this term for all these diseases.

Malaria, from being a classical term for bad air, has come by custom to be attached to that class of fevers and allied ailments which are derived from vegetable or earth effluvia, and have periodicity as a distinctive symptom. The revised Anglo-American nomenclature confines malaria to remittent fever and ague. This is right. We would confine the word malaria very narrowly to that class of diseases believed to be dependent on marsh emanations, which, when received into the human system,

produce fevers or attacks having a marked periodicity, and would thus recognize it as a subdivision under the miasmatic class.

The term zymotic (from ζυμος, a ferment), as specifically applied by Farr and others, resulted from Liebig's two volumes on the chemistry of agriculture, in which the doctrine of fermentation was so set forth as to lead to its full acceptance as an explanation of many diseases. "The diseases of this class," says Dr. Farr, "have been frequently spoken of as fermentations; and Liebig has now opened the way to the explanation of their nature by a reference to the phenomena attending the transformations of organic compounds excited by the action of other compounds simultaneously undergoing analogous transformations" (p. 200, Fourth Report).

"The property of communicating their action, and effecting analogous transformations in other bodies, is as important as it is characteristic in these diseases, which it is proposed therefore to call, in this sense, zymotic. A single word, such as zymotic," said he, "is required to replace in composition the long periphrasis epidemic, endemic, and contagious"[1] (p. 201, cit.).

With the new light thrown by recent investigation on the communicable diseases, we see no reason for the retention of the word "zymotic." We would banish it from our revised nomenclature, and call the first class communicable diseases, instead of specific febrile diseases, or zymotics.

The words epidemic, endemic, and sporadic, in their use, also need to be settled down into a specific meaning. We have seen that Dr. Farr accepted zymotic as inclusive of epidemic, endemic, and contagious diseases. With the banishment of the word, and of talk about infection, we would come to ask whether the word epidemic is to be kept as loosely expressive of something prevailing among the people, endemic of something prevalent in a locality, and sporadic of some endemic here and there recurring. Dr. Farr speaks of endemics, as diseases which prevail *only* in particular localities; of epidemics, as those which extend, like cholera, over nations, or are propagated by contagion; and of sporadic diseases, as those which arise in an isolated manner from ordinary causes and sources existing in the organization itself. Such a definition hardly accords with what is at present common use. As to endemics, authorities most frequently mean by this term "a disease continuously present in a locality, to however limited a degree," or one that has been shown as specially prone to recur in that section of country.

Dunglison defines sporadic as denoting "diseases which supervene in every season and situation from accidental causes, and independently of any epidemic or contagious influence; scattered, not epidemic." If the definition of Dunglison is to be accepted, we should never speak of sporadic cases of scarlet fever, diphtheria, etc., but either forsake the use of the term, or use it only as to colds, rheumatism, or some other non-communicable disease prevailing in a locality. So far as the terms are descriptive of diseases, we only need the two terms epidemic and endemic.

Whenever a communicable disease comes to prevail generally or extensively in a country, and is there found to be prevalent without any well defined local cause, it is said to be epidemic, for it is a disease capable of prevailing in very many other places, or generally, without our being able to trace its origin to any ascertained local condition peculiar to that place. If, on the other hand, a disease prevails in a locality where it shows itself to be dependent upon local conditions, and not to be transmissible so as to prevail elsewhere without the some conditions are reproduced, we call it endemic.

The term portable is somewhat descriptive of those diseases which are communicable or transmissible by some form of conveyance of contagious particles from persons, while fomites (Latin *fomes*, fuel) is used to denote any porous substance capable of absorbing, retaining, or transmitting the contagious particles. The fomitic portability or transmissibility of many diseases is well established.

If the few terms we have named could be chosen out of our confusion of terms, and come to be well understood, as they thus would be, a great service would be done to the science of hygiology.

The word "quarantine" should give place to the term port and ship sanitation, as being more expressive and indicative of present practice.

STATISTICAL NOSOLOGY.

Statistical nomenclature, while in accord with medical nosology, should, says Dr. Farr, "be founded upon the mode in which diseases affect the population." Should it not, however, have some regard to etiology, since it is designed to aid us in the study of prevention?

For the present it is best for us to avail ourselves of the nosology of the joint international committee, as used in the registrar-general's report for England and Wales, but also to bear in mind the need of new distinctions, such as are furnished by a closer knowledge of the causes of disease, and by clearer lines between those which are communicable and those which are not. We submit that every student of etiology, taking this nomenclature as a working basis, should note beside it any comments which more recent clinical observation and experience may suggest. For instance, the question can easily be raised whether acute hydrocephalus is always tubercular meningitis, and so always to be classed under the constitutional diseases, instead of with diseases of the brain or nervous system. Similar questions can be started as to the placing of erysipelas with septic diseases, and rheumatic fever with constitutional diseases.

The four first divisions of the statistical nosology especially need occasional notes from students of etiology and practical sanitarians. For our advances in a knowledge of etiology it is certain that any such nosology must be held as a convenient working form, subject to decennial or more frequent revision.

It is best to use the term demography as including all that relates to the vital movements and social status of nations, while vital statistics embrace

not only morbility and mortality, but also statistics of marriage, births, and divorce, and such statistics as relate to disease, pauperism, and crime, as conditions of population too often closely connected therewith. We are yet in need of a better classified arrangement of the items which make up the entire division of vital statistics.

PARASITIC NOMENCLATURE OF DISEASE.

Since we have come so fully to recognize that many diseases are of parasitic origin, either animal or vegetable, or that the differential diagnosis depends mostly or entirely upon microscopic appearances, we need to review, and, so far as possible, settle upon the terms. We are able more readily to do this when we come to compare the appropriateness of the terms with their real derivative meaning. We may enumerate some of them, as follows:

Micro-organisms, . . .	little organized particles.
Microbes or microbia (Pasteur), . .	little living things.
Microzoa, ...	little animals.
Microphytes, ...	little plants.
Microzymes, ...	little ferments.

As general terms, micro-organism, microbes or microbia, microphyte, microdemes, and microzymes are frequently used. The first is the best to designate the entire order of microscopic life, as studied in its relation to disease. Microbes or microbia is also a term inclusive of all minute being or life. Microzoa or microzoic is the best term to denote such of these organisms as are animal. Microphyte is the best general term for the vegetative organisms. Since the doctrine of ferments has been modified, microzyme is not needed at all. Microdeme should fall into disuse because microzoa is more descriptive. Instead of germ diseases, we much prefer the name of parasitic diseases.

With these terms the statement would be thus: Parasitic diseases are of two kinds,—those depending on animal and those on vegetable life. These, when belonging to the minutest forms of life, are called micro-organisms or microbia; such as are animalculæ are called microzoa, and those which are vegetative, microphytes. We can thus speak of microzoic and microphytic diseases. As to the animal parasitic diseases, it is not necessary to quote the outline of Cobbold, which has long been, and remains, the best classification.

Just as he speaks of the entozoa parasites as forming a peculiar or "specialized fauna destined to occupy a peculiar territory of widespread domain in the interior of the bodies of man and animals," so we are to regard vegetable parasites as forming a peculiar or specialized flora, destined to occupy an equally wide domain in the human system and that of other animals. We may add of these what he adds as to the fauna: "Each bearer or host may be viewed as a continent, and each part or viscus of his body may be regarded as a district. Each district has its special attractions for particular parasitic forms, yet at the same time

neither the district nor the continent are suitable as permanent resting-places for the invader. None of the internal parasites 'continue in one stay;' all have a tendency to roam; migration is the soul of their prosperity—change of residence the essential of their existence; while a blockade in the interior soon terminates in degeneration and death." Like the entozoa, "they strictly conform to a few well known types of structure, but these types branch out into infinitely varied specific forms."

The micro-organisms, or *microphytes* of the vegetative type, as found in the body or related to disease, are classed with or between the algæ and fungi, and were first termed schizomycetes, because they were thought to multiply only by fission, or division. Schizophyte was another early name. Microphyte is a good substitute. There are four well marked groups, namely,—Bacteria, small oval or slightly elongated bodies; bacilli, rod-shaped bodies; micrococci, little grains or round bodies; spirochætæ, spiral bodies.

These are the divisions adopted by Cheyne and founded upon the classifications of botanists, and for the present serve to embrace all microphytes. The most usual forms of growth are by fission, in which the microphyte elongates and divides. Growth also occurs by spores, which appear in the elongation or threads as bright, refracting, round, or oval bodies, and which are set free by the disappearance of the threads. These spores are more permanent in their vital properties than the microphytes from which they are derived. Multiplication also takes place by budding.

Where the microphyte is of a fungous kind, and involves only the skin as its host, it is said to belong to the mycoses. Examples of these are found in ring-worm and in the actinomycosis of cattle.

These are but families embracing several species. It is not our design to trace a perfect classification, as this is, for obvious reasons, impossible. But it is a progress if we are able to furnish, in the science of hygiology, and in its statistical and parasitical divisions, a provisional nomenclature which can be gradually improved as our knowledge becomes more accurate. We present this merely as a nucleus for a more exact nomenclature, in order that unnecessary names may be retired from use, and that those employed and retained may have no doubtful signification. Thus, by retaining less than half the terms now too often promiscuously used, we would be able more accurately and clearly to express all that is at present known as to communicable diseases.

VI.

AN EPIDEMIC OF TYPHOID FEVER.

By C. A. LINDSLEY, M. D., Secretary of the State Board of Health of Connecticut, New Haven.

My purpose is simply to bring to the notice of this association a well marked instance of an outbreak of typhoid fever in a country village, occurring in connection with an extremely low elevation of ground-water. The relation of typhoid fever to this depression of water in the soil is one which has excited a growing interest of late years, and which has been carefully studied, chiefly by Pettenkofer, of Munich, in the old country, and by Baker, of Michigan, in this country.

About the middle of last September, I was informed by a temporary resident of Madison, in the state of Connecticut, of this outbreak of fever, as of quite sudden invasion, limited to narrow territorial boundaries, and attacking so many as to alarm the small population of the place. A letter of inquiry addressed to Dr. D. M. Webb, the most prominent physician of Madison, elicited the following reply:

"On the 18th of August I was called to see a ten-year-old lad, whose family were spending the summer here. The boy had malarial-typhoid fever,—that is, he had typhoid fever, with symptoms of a malarial element complicating it. The diagnosis of this and of the cases following was unquestionable: the diarrhœa, the characteristic eruption, and other distinctive symptoms left no doubt on that score. On the 1st of September, twelve days after I first saw the boy, I was summoned to two other similar cases in other houses, but not far away; and to others still on the 2d, 3d, 7th, 8th, 15th, 19th, and 26th of the same month, counting in all sixteen cases, and most of them within half a mile of my house, besides several others in adjoining towns."

One young man whose sister had the fever returned to his business in New Haven, after a visit to his family in Madison of a week's duration, in August, and was shortly after prostrated with it.

At the invitation of Dr. Webb I visited Madison on the 28th of September. The topography of Madison is peculiar, and in this connection is interesting. It is a farming town of about 1,600 inhabitants, a little less than half of whom reside in a somewhat compact village located upon the shore of Long Island Sound, and enjoying some repute as a summer resort for such as love the retirement of a quiet country life by the sea-side.

This village part of the town is built upon a level plain, on streets running nearly parallel to the shore, and about half a mile inland. The soil of this part is very porous, consisting of sand and gravel.

The surrounding vicinity presents an exceedingly varied character within a quite limited territory. It is both rocky and swampy; it is level and hilly by turns. Trap-rock suddenly crops up above the surface in many places, while level meadows and fertile hill-sides border upon many small areas of wet lands and little swamps. Such is the general surface of the ground about the village. Within its limits, and quite near to habitations, is a deep, natural excavation filled with water supplied from springs, and known as Tuxis pond. It covers several acres. It has no natural outlet. An artificial ditch, now obstructed, has heretofore partially drained it. The water in the pond was low. Unevenness of surface, and remarkable variety in the quality and humidity of the soil, are the conspicuous peculiarities surrounding the village.

The domestic sanitation of Madison is not specially different from that of other country places. The disposal of garbage is not by systematic removal. Poultry and swine make their selections from it, and the remainder decays upon the surface of the ground, or is added to the compost heap, and thus returned to the soil as a fertilizer. Sewage is usually sent to that reservoir of nastiness, the cesspool, as no system of sewerage exists by which it can be removed. Leaching privy vaults are in universal use. The water-supply is wholly by wells, the average depth of which is only twelve or fourteen feet.

All these conditions have existed practically as they are now for many years. Madison is noted in Connecticut for nothing so much as for being exactly what it always has been, with a reliable prospect of continuing in that unchanging sameness for an indefinite period in the future. The population is about the same as it was a hundred years ago, and has not been greatly reduced by this epidemic. There has been only one death, and that from intestinal hemorrhage, at the close of the second week of the fever. The fixed habit, so long indulged in by this conservative community, of dying of old age, is not to be easily broken by any ordinary pestilence.

Notwithstanding all the above mentioned conditions, so favorable in the eye of the modern sanitarian to the development of typhoid, it has never until the month of September prevailed in Madison. An occasional sporadic case has been the only form in which it has before appeared. Dr. Webb, who has practised there for thirty years, and almost alone, says he has never met with more than one or two cases a year, and in some years with none.

There are no facts respecting garbage, sewage, cesspools, pig-styes, barn-yards, or privies which have been discovered to distinguish the houses in which the fever occurred from other houses. Indeed, nothing has been found bearing upon the special etiology of this outbreak, except an unusually low elevation of ground-water. To so marked a degree has the water-level fallen, that nine tenths of the wells in the vicinity of the

epidemic became dry. This is a measure of drouth very much exceeding any previous drouth within the memory of the old residents.

Dr. Webb, who is a careful and intelligent observer, has been unable to trace any connection between the first case and the subsequent ones. It would be rash presumption, however, to deny the possibility of such connection. The first victim was a boy—a typical boy of the ten-year-old variety, just from the restraints of city life, and having a good time in the country. He was ubiquitous—had a personal acquaintance with every other boy in the place; one of whom almost every housekeeper could say, "Yes, I know him: he was here lately with some other boys."

An analysis of the water was made from three of the wells used by victims of the fever. The result was just what could have been predicted from the known conditions, viz., an excessive amount of solids, with chlorine and nitrates and nitrites in great quantity, and also free ammonia and albuminoid ammonia. The microscope revealed hosts of animal and vegetable forms of low type.

Such are the principal facts relating to this little epidemic, so far as I have been able to obtain them. The narration of them is not offered as presenting anything new. Every fact mentioned has been observed before. Nor are they stated in defence of any theory, or as the basis of any conclusions respecting the infection of typhoid fever; but the sole purpose is to add to the recorded instances another apparently well marked illustration of the influence which variations in the amount of water in the soil seem to exert upon the prevalence of this dangerous disease.

VII.

STATISTICS OF CONSUMPTION IN RHODE ISLAND.

By CHARLES H. FISHER, M. D., Secretary State Board of Health of Rhode Island.

It is solely the object of this paper to present the statistics of pulmonary consumption in Rhode Island as a cause of death, and the relations of the various circumstances and conditions of the decedents to mortality therefrom. The numbers are not large in magnitude; the territory from which the facts are derived is not large in extent; and the period of time which they cover extends only to twenty-five years.

The facts presented, however, are complete and absolute, and may furnish material not only for comment and speculation, but also positive data for some definite conclusions.

Table I will exhibit the relations of sex, season, and parentage; Table II, the various periods of life; and Table III, the various occupations of the decedents.

The diagram will present the proportional mortality of a number of the most prominent causes of death in comparison with consumption.

Sex. Of the deaths from consumption during the period of twenty-five years, 6,653 were males, and 8,258 were females,—an excess of 1,605 females; or a proportion of 124 female decedents to every 100 male decedents. The ratio of the sexes by population is about 106 females to every 100 males.

An excess of female decedents from consumption is the rule during every month of every year, with scarcely any exceptions. The same rule holds true in relation to the ages of the decedents, that is, more females in every period of life than males, with the exception occasionally of a larger number of males between the ages of 3 and 5, and between 50 and 60.

Season. It is popularly supposed that more deaths occur from consumption during the winter months than during any other months of the year. It will be seen, however, by reference to Table I, that March has the unenviable distinction of furnishing the largest mortality from that disease.

The months in which the mortality from consumption occurred during the period of twenty-five years, in the order of from the largest to the smallest, are as follows: March, 1,323; August, 1,317; December, 1,309; April, 1,302; May, 1,273; January, 1,245; October, 1,238; September, 1,282; November, 1,229; June, 1,156; February, 1,145; July 1,142.

TABLE I.

Giving the number of deaths from pulmonary consumption in Rhode Island, by months, sex, and parentage, in aggregates of five years each, from 1860 to 1884, inclusive, also various summaries.

PULMONARY CONSUMPTION. YEARS.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Parentage.		Sex.		Total.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Am.	For.	M.	F.	
1860 to 1864, inclusive.....	103	95	94	108	97	122	102	124	78	104	92	101	86	95	99	125	86	145	93	130	107	110	122	126	.....	.....	1,159	1,385	2,544
1865 to 1869, "	99	113	90	108	114	130	107	123	94	103	110	97	90	121	110	133	108	132	107	134	110	125	105	127	1,575	1,115	1,244	1,446	2,690
1870 to 1874, "	128	116	92	139	106	129	103	127	117	142	79	134	89	134	98	130	103	134	93	132	92	133	117	141	1,507	1,301	1,217	1,591	2,808
1875 to 1879, "	127	170	104	136	145	166	121	146	131	176	119	145	114	137	123	168	110	140	102	151	125	145	115	163	1,499	1,780	1,436	1,843	3,279
1880 to 1884, "	131	163	134	140	154	160	153	196	145	183	115	164	124	152	123	208	117	157	142	154	128	154	131	162	1,399	2,191	1,597	1,993	3,590
Total sexes by months......	588	657	514	631	616	707	586	716	565	708	515	641	503	639	553	764	524	708	537	701	562	667	590	719	.....	.....	6,653	8,258	14,911
Totals each month.........	1,245		1,145		1,323		1,302		1,273		1,156		1,142		1,317		1,232		1,238		1,229		1,309		.....	.....	....		14,911
Totals parentage, 20 years*	......		......		......		......		......		......		......		......		......		......		......		......		5,980	6,387			
	1st quarterly period.						2d quarterly period.						3d quarterly period.						4th quarterly period.										
Totals of quarterly periods..	3,713						3,731						3,691						3,776						....		....		14,911
	1st half of the year.												2d half of the year.																
Totals of each 6 months....	7,444												7,467												....		....		14,911

* Parentage not reported previous to 1865.

TABLE II.

Showing the mortality from pulmonary consumption in Rhode Island, at different ages and of each sex, in periods of five years each, from 1860 to 1884, inclusive, with percentages of the same at different periods of life.

PULMONARY CONSUMPTION. YEARS.	Under 1.		1 and under 2.		2 to 5.		5 to 10.		10 to 15.		15 to 20.		20 to 30.		30 to 40.		40 to 50.		50 to 60.		60 to 70.		70 to 80.		80 to 90.		Age not stated.		Sex.		Total.
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
1860 to 1864, inclusive..	...	...	...	...	*88	*80	10	17	16	28	101	136	270	377	223	295	175	180	127	100	88	105	44	52	14	11	3	4	1,159	1,385	2,544
1865 to 1869, "	33	44	20	18	16	20	14	14	12	26	81	163	356	406	234	252	174	184	131	125	106	122	53	53	10	14	4	5	1,244	1,446	2,690
1870 to 1874, "	23	29	19	20	13	13	6	8	11	30	93	167	312	492	245	297	168	207	145	134	110	108	58	69	10	13	4	4	1,217	1,591	2,808
1875 to 1879, "	34	31	12	19	15	9	13	18	15	46	106	242	428	563	278	347	198	214	144	151	117	119	62	69	10	14	4	1	1,436	1,843	3,279
1880 to 1884, "	35	40	22	18	14	13	9	13	18	45	111	215	528	658	306	422	221	223	146	147	118	105	49	64	14	22	6	8	1,597	1,993	3,590
Totals each sex by ages..	125	144	73	75	146	135	52	70	72	175	492	923	1894	2496	1286	1613	936	1008	693	657	539	559	266	307	58	74	21	22	6,653	8,258	14,911
Totals of sexes by ages..	269		148		281		122		247		1,415		4,390		2,899		1,944		1,350		1,098		573		132		43		....		14,911
Total under 5 years	....		698																												
Per cent. different ages..	1.80		0.99		1.88		0.82		1.66		9.49		29.44		19.44		13.05		9.06		7.36		3.84		.89		.28		100.00		
Per cent. under 5 years..	....		4.67																												
Per cent. 5 to 20 years..	....		....		....		....		11.97																						
Per cent. 20 to 40 years..	....		....		....		....		....		....				48.88																
Per cent. 40 to 60 years..	....		....		....		....		....		....		....		....				22.11												
Per cent. 60 to 80 years..	....		....		....		....		....		....		....		....		....		....				11.20								

* Including all under 5 years of age. Ages under 5 not specified in tabular reports previous to 1865.

Pulmonary consumption, as a disease, is more evenly distributed through all the months of the year than any other, and deaths therefrom maintain a corresponding uniformity. There is usually a somewhat increased mortality from the debilitating effects of close confinement during the winter months, and from the enervating effects of continued heat at the close of the summer months.

The different quarters of the year, in the aggregates of twenty-five years, show a mortality in numbers, as follows: 1st quarter, 3,713; 2d quarter, 3,731; 3d quarter, 3,691; 4th quarter, 3,776.

Age. While no period of life is exempt from the ravages of consumption, there is a very strongly marked difference in the mortality at different ages. During the twenty-five years comprised in the tables on previous pages, the average proportions in every 1,000 deaths from consumption were as follows:

	In every 1,000.		*In every* 1,000.
Under 1 year of age	18.0	30 to 40 years of age	194.4
1 and under 2 years of age	9.9	40 to 50 "	130.5
2 and under 5 "	18.8	50 to 60 "	90.6
5 to 10 "	8.2	60 to 70 "	73.6
10 to 15 "	16.6	70 to 80 "	38.4
15 to 20 "	94.9	80 to 90 "	8.9
20 to 30 "	294.4	Age not stated,	2.8

Longer periods of life may be taken as follows:

	In every 1,000.		*In every* 1,000.
Under 20 years of age,	166.4	60 to 80 years of age,	112.0
20 to 40 "	488.8	80 to 90 "	8.9
40 to 60 "	221.1	Not stated,	2.8

It will be seen that nearly one half of the mortality from consumption occurs in the period of life between 20 and 40 years of age.

RATIO TO POPULATION OF SAME AGE.

	Per Cent. of Deaths from Consumption.	*Per Cent. of Population.*
Under 5 years,	4.67	10.74
5 to 20 "	11.97	29.07
20 to 40 "	48.88	34.55
40 to 60 "	22.11	18.30
60 to 80 "	11.20	6.71
80 to 90 "	.89	.57

Under 20 years of age, the proportion of deaths from consumption is less than the proportion of that class of population by age to the whole population, by about 40 per cent. Above 20 years of age the tide turns. From 20 to 40 years of age, the proportion of decedents from consump-

tion is larger than the proportion of that class to the whole population, by about 40 per cent. From 40 to 60 years, it is larger by about 20 per cent., and above 60 years, by more than 60 per cent.

It does not seem by the results of registration, and by the comparison of the same with the population of the same age, that advanced life acquires any immunity from the development of pulmonary consumption; but that the lessened number of decedents is due to the diminished number of living individuals of that advanced age. And more than that, statistics seem to show, on the other hand, that beyond the sixtieth year of life there is an increased disposition to the development of pulmonary diseases.

Proportion of deaths from consumption to total deaths from all specified causes:

	5 years.	5 years.	5 years.	5 years.	5 years.
Annual average,	1860–'64	1865–'69	1870–'74	1875–'79	1880–'84
Percentage,	18.70	18.74	15.56	15.83	14.80
Per 1,000,	187.0	187.4	155.6	158.3	148.0

The preceding summary will show the average annual percentage of deaths from consumption, in proportion to all other stated causes, in each period of five years, from 1860 to 1884 inclusive.

The percentage is based upon the returns of deaths, giving the cause of death. The number of deaths returned, with cause unknown, varies from year to year considerably, but with a gradually diminishing proportion. During the year 1884 the number was 42. It was the smallest ever returned in any single year. Some slight allowance may be made, therefore, in the percentages of the two or three earlier periods of five years.

CONSUMPTION.—PROPORTION OF DEATHS TO POPULATION.

In ascertaining the proportion of deaths from consumption to the living population in each of the five-year periods, the basis of computation is obtained by adding to the population, taken by the state or national censuses at the beginning of each five-year period, one half of the increase of population during that period, ascertained by the census taken at the beginning of the succeeding five-year period. An average is thereby found, which, if not absolutely and mathematically exact, is very close, and sufficiently approximate thereto.

Decedents from Consumption, 1860 *to* 1884, *inclusive.*

OF POPULATION.	5 years, 1860–1864, inclusive.	5 years, 1865–1869, inclusive.	5 years, 1870–1874, inclusive.	5 years, 1875–1879, inclusive.	5 years, 1880–1884, inclusive.
Annual average, one in every .	353	374	423	424	404
Annual average in every 10,000	28.3	26.7	23.6	23.5	24.7
Aggregate in every 10,000 . .	141.5	133.5	118.0	117.5	123.5

The results of investigation show that consumption as a cause of death has diminished in frequency since 1860, commencing with an average proportion of 28.3 annually in every 10,000 of the population during the five years from 1860 to 1865, and closing with an average annual proportion of 24.7 during the five-year period ending Dec. 31, 1884. It will be seen, however, that the diminution has not been by regular gradation, the third and fourth five-year periods showing an annual average proportion to population somewhat smaller than the last period.

CONSUMPTION.—PROPORTION OF DEATHS TO POPULATION BY PARENTAGE.

In the previous consideration of the proportion of deaths from consumption to population, regard was had to the *total* population, comprising all of the two distinctive classes, that is, American and foreign. It is now proposed to consider the proportions of the two classes (American and foreign) separately, that is, the number of deaths from consumption in each class, in periods of five years each, as before.

There can be, however, but four periods of five years each in such consideration, as the tabulated reports of the parentage of decedents were not made previous to 1865.

Decedents of mixed parentage, *i. e.*, of American father and foreign mother, and *vice versa*, are classed with the parentage of the fathers.

It is necessary, in this connection, to make use of the census enumerations taken during the first year of each five-year period, as the enumerations of the census of 1885, in relation to the population by parentage, have not at the time of this writing been completed.

The circumstance, however, is consequential only so far as the increase of population in the one class may have been greater than in the other. Whatever difference there may have been would doubtless be in favor of the class of foreign parentage. That the reader may form some estimate of what such small difference might be (the proportions being each for its own class), the populations of the two classes at the commencement of each five-year period are given:

	1865.	1870.	1875.	1880.
American parentage,	117,316	124,591	134,722	139,117
Foreign parentage,	67,649	92,762	123,517	137,414

The whole number of decedents from consumption in each class during each period of five years, were as follows:

	1865-1869. No. Deaths from Consumption.	1870-1874. No. Deaths from Consumption.	1875-1879. No. Deaths from Consumption.	1880-1884. No. Deaths from Consumption.
American parentage,	1,1570	1,507	1,499	1,399
Foreign parentage,	1,114	1,301	1,780	2,191

The following summary will show the *proportional* mortality from consumption in each class, in each period of five years:

Deaths from Consumption.

	5 years. 1865-1869. Annual Average.	5 years. 1870-1874. Annual Average.	5 years. 1875-1879. Annual Average.	5 years. 1880-1884. Annual Average.
Of population,	One in every	One in every	One in every	One in every
American parentage	372	413	449	497
Foreign parentage,	303	356	347	313

The reader will scarcely fail to observe the regularity with which the proportions of deaths from consumption in the population of American parentage have diminished during the twenty years. At the same time, it will be seen that the mortality from the same disease in the population of foreign parentage holds nearly the same proportion to the population of that class in the last five years, as in the first.

Another method of presenting the varying proportions of mortality from consumption during twenty years in the two classes of population may have some advantages, in that the results may be more immediately obvious, as follows:

Average Annual Number of Deaths in Each Period.

	5 years. 1865–1869	5 years. 1870–1874	5 years. 1875–1879	5 years. 1880–1884
	In every	In every	In every	In every
Of population,	10,000	10,000	10,000	10,000
American parentage,	26.8	24.2	22.3	20.0
Foreign parentage,	33.0	28.1	26.0	31.9

Again will be seen the diminution by regular gradation of the percentage of decedents from consumption in the population of American parentage, and the approximate maintenance in the last five-year period of the average proportion of the first five-year period, in the population of foreign parentage. The more favorable occurrence of diminished proportion during the second and third periods is shown to have taken a more unfavorable turn in the fourth.

It should be understood that the term "foreign parentage" is meant to include not only all persons of foreign birth, but also all persons born in the United States whose parents were foreign born. And therein is the limit of foreign parentage, as the term is used in this paper.

All persons who were born in the United States, of parents whose birth also occurred in the United States, are reckoned as of American parentage, although their grandparents may have been foreign born, and their parents reckoned as of foreign parentage.

The following table will show the number of deaths from consumption of persons of twenty years of age and over, who were engaged in various occupations, with the number of decedents in each occupation, and the whole number of persons engaged in the same occupations, by the census of 1875.

TABLE III,

Exhibiting the number of decedents from consumption engaged in different occupations during twenty-five years, from 1860 *to* 1884 *inclusive; and also the number of persons engaged in the same occupations by the census of* 1875. *Ages under twenty excluded.*

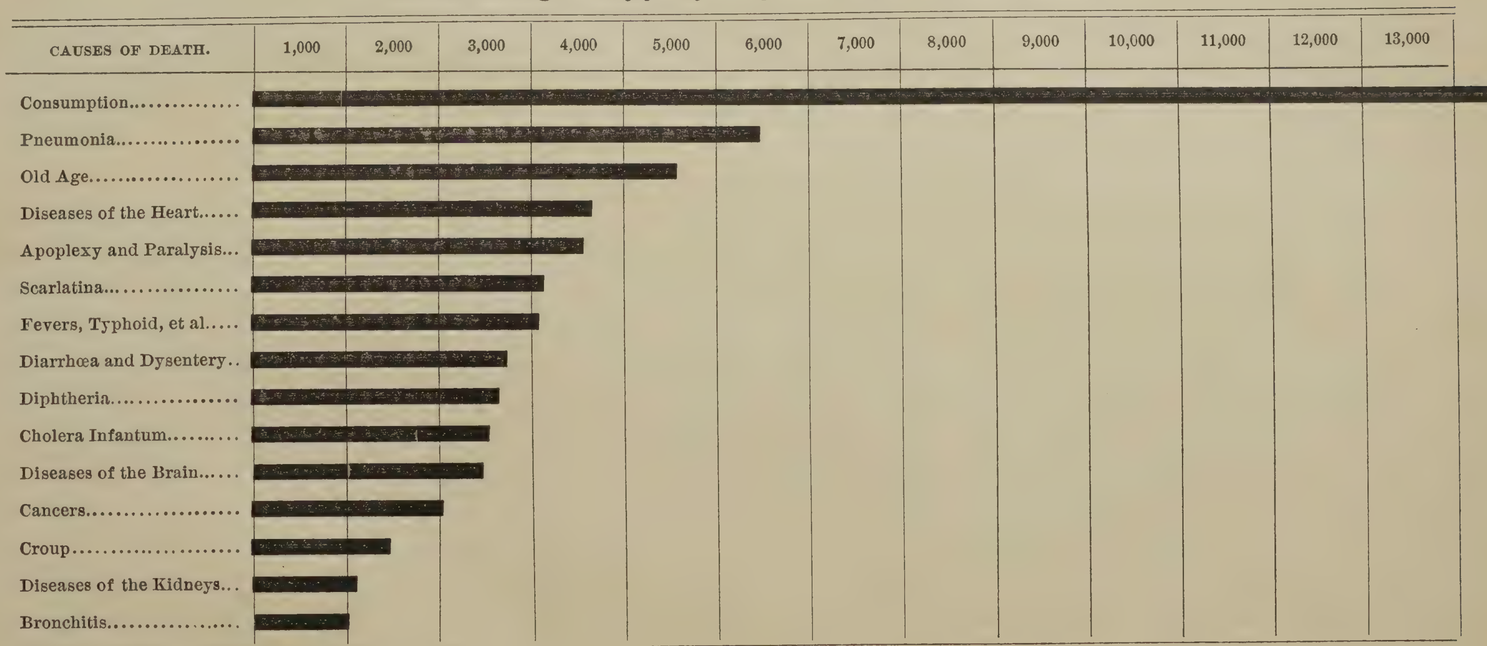
OCCUPATIONS.	No. of decedents from consumption.	No. pers'ns in each occupat'n, 1875.
I. Agriculture.		
Farmers,	461	11,075
Florists,	6	65
Gardeners,	19	560
II. Professional and personal services.		
Actors,	3	43
Artists,	7	82
Architects,	1	60
Barbers,	50	368
Canvassers,	1	33
Civil engineers,	4	131
Clergymen,	14	316
Clerks and salesmen,	193	3,780
Coachmen,	30	396
Collectors,	1	42
Constables,	2	
Cooks,	5	321
Dentists,	1	71
Hostlers,	13	489
Hotel-keepers,	11	136
Janitors,	5	63
Journalists,	1	44
Laborers,	1,143	7,928
Lawyers,	5	186
Musicians,	4	122
Music-teachers,	2	70
Nurses,	1	42
Photographers,	3	84
Physicians,	27	367
Policemen,	6	
Saloon keepers,	28	360
Stable keepers,	9	179
Students,	13	517
Teachers,	25	232
Undertakers,	2	61
Waiters,	24	474
Watchmen,	9	323
III. Trade and transportation.		
Agents—insurance,	5	118
" local,	9	197
" travelling,	2	106
Apothecaries,	6	199
Bankers and brokers,	7	114
Book-keepers,	60	840
Brakemen,	6	119
Butchers,	26	586
Car-drivers,	1	68
Cashiers (bank, &c.),	2	106
Collectors,	1	42
Confectioners,	2	78
Conductors (car),	3	117
Expressmen,	5	232
Fishermen and oystermen,	22	789
Grocers,	44	1,018
Hackmen,	5	165
Liquor dealers,	16	124
Mariners,	79	700
Marketmen,	2	378
Merchants,	101	1,711
Milkmen,	1	107
Peddlers,	18	401
Pilots,	2	41
Porters,	5	143
Railroad station agent,	3	66
Sea captains,	2	48
Stevedores,	1	47
Teamsters,	49	2,072
Telegraphers,	2	85
Tobacconists,	2	52
Traders and dealers,	43	1,618
IV. Manufactures, mechanical and mining industries.		
Bakers,	15	317
Belt-makers,	1	68
Blacksmiths,	91	1,263
Bleachers,	10	370
Block-makers,	1	24
Boat-builders,	2	37
Boiler-makers,	14	148
Book-binders,	5	75
Boot- and shoe-makers,	87	690
Brewers,	2	32
Brush-makers,	2	36
Cabinet-makers,	19	324
Calico-printers,	2	50
Carpenters,	122	4,771
Carriage-makers,	9	348
Cigar-makers,	23	299
Confectioners,	3	70
Coopers,	11	120
Die sinkers,	2	51
Dyers,	10	370
Engineers and firemen,	22	835
Engravers,	23	266
File cutters,	14	305
Gas fitters,	10	152
Gunsmiths,	1	430
Harness-makers,	21	214
Hatters,	4	37

TABLE III—*continued.*

OCCUPATIONS.	No. of decedents from consumption.	No. pers'ns in each occupat'n, 1875.	OCCUPATIONS.	No. of decedents from consumption.	No. pers'ns in each occupat'n, 1875.
Jewellers, ...	186	2,881	Silversmiths, ...	20	310
Machinists, ...	208	2,380	Stair-builders, ...	3	48
Manufacturers, ...	44	677	Stone-cutters, ...	46	734
Masons, ...	73	1,839	Stucco-workers, . . .	1	42
Mechanics, ...	88	1,444	Tailors, ...	58	658
Millers, ...	5	43	Tinsmiths, ...	17	356
Millwrights, ...	3	18	Tool-makers, ...	3	70
Moulders, ...	43	980	Upholsterers, ...	11	136
Operatives, ...	370	16,358	Watch-makers, ...	7	115
Overseers and superintendents, ...	16	228	Wheelwrights, ...	8	142
Painters, ...	100	1,658	Wire-workers, ...	1	29
Pattern-makers, ...	4	145	*V. Females.*		
Paper-hangers, ...	2	45	Box-makers, paper, . .	2	142
Piano-makers, ...	1	8	Cigar-makers, ...	2	102
Pavers, stone, ...	1	40	Dressmakers and seamstresses, ...	71	2,557
Plumbers, ...	15	385	Milliners, ...	12	640
Pork-packers, ...	2	36	Nurses, ...	3	302
Printers, ...	35	392	Operatives, ...	204	14,900
Riggers, ...	1	18	Servants, ...	56	5,906
Roll coverers, ...	2	64	Sisters of Mercy, . . .	11	
Rope-makers, ...	2	31	Tailoresses, ...	28	880
Rubber-workers, . . .	14	680	Teachers, ...	39	1,153
Sail-makers, ...	1	49			
Ship carpenters, . . .	5	89			

DIAGRAM

Exhibiting the comparative mortality by absolute number of decedents from fifteen most important causes of death, in Rhode Island, during twenty-five years from 1860 to 1884 inclusive.



VIII.

METHODS OF TABULATING AND PUBLISHING RECORDS OF DEATH.

By JOHN S. BILLINGS,
Surgeon U. S. Army.

Every one who has had occasion to examine published records of vital statistics will agree that it is very desirable that these should be prepared upon some uniform plan. At present there is great diversity in the forms used by those states and municipalities which have a system of registration; and while this diversity extends to the original data, as well as to the form in which these data are presented, it is much greater in the latter than in the former. In the following paper it is proposed to consider, as briefly as possible, some of the principal varieties of these forms now used in civilized countries, and to what extent they meet the wants of statisticians and sanitarians.

First, let us try to define these wants, in order that we may have some standard for comparison; and to simplify this part of the subject, let us consider the needs of a health officer of a city. He desires information of the first appearance of any of those diseases which are liable to become epidemic; of the usual prevalence of any form of disease; of the localities of such prevalence; of the effects produced on health by certain occupations, manufacturing establishments, tenement-houses,—things which are complained of as nuisances,—or by measures taken to effect improvement, such as the introduction of a general water-supply, the construction of drains and sewers, etc. In order that he may, from the statistical records, determine where sanitary work is most needed, and whether the steps which have been taken to effect improvement have really been useful or not, he must have the information for individual localities, and sometimes for quite limited ones, as well as for the whole city. This information, to be practically useful, must, as a rule, be in the form of percentages or ratios, in order to permit of comparisons. These ratios should be stated in terms of the living population furnishing the sickness or deaths under consideration, wherever it is possible to give this information. Hence it is highly important to know the population of each of the units of area adopted.

As a matter of fact, no health officer expects to be able to ascertain the number of cases of sickness in any locality. The best that he can hope to do is to ascertain the general character of the prevailing diseases, the number and location of cases of a few of the specially contagious forms of

disease, and the number of deaths from each cause. If he can obtain these promptly and accurately he will be unusually fortunate, and from these data he can draw valuable inferences as to the amount and character of preventable disease existing in the community at a given time, and also as to the connection between certain forms of disease and death, and the circumstances of the environment, in order to know what diseases are preventable, and how this prevention is to be effected.

For the first of these purposes he needs the results as promptly as possible: weekly bulletins are the usual form in which they are given to the public. For the second purpose, careful study of the facts in all their relations is necessary, and also the accumulation of a large number of facts. This requires time, and such studies usually appear in annual, quinquennial, or decennial reports. We have therefore to consider the best forms for weekly reports, which are essentially reports of warning, provisional and incomplete; and for annual or other reports, which are intended to record the facts as completely as possible, and in the form most convenient for study, which, in other words, are to furnish the materials for vital statistics, properly so called. The first point to which I wish to call special attention is, that as the purposes of these two forms of reports are quite different, and the data most needed for them also differ to a considerable extent, it is not wise to endeavor to combine them,—that is, to try to make the weekly form so complete and elaborate that the annual report need be little more than a summary of the weekly forms. The result of such an attempt must be either that the annual report is incomplete and unsatisfactory, or that the weekly report is greatly delayed, the former being the general rule.

Let us first consider the forms to be used in the annual reports,—in other words, the most complete statistical data which are to be published. In a complete report of the deaths occurring in a given locality, as a state or city, during a year, the following are the distinctions most usually made: viz., 1, sex; 2, ages, by groups, either decennially or quinquennially; 3, color; 4, localities, or units of area, as counties, wards, etc.; 5, causes of death; 6, time of year, by weeks or months; 7, occupations; 8, birthplace; 9, parentage or race; 10, conjugal condition, or, as it is often called, civil condition. In addition to these ten principal circumstances, which it is desirable should be recorded so far as possible in relation to each case of death, it would be very desirable, if it could be accomplished, to record also what may be termed the social condition of the decedent,—that is to say, whether very poor, in comfortable circumstances, or rich. One great difficulty in doing this is to agree upon some principle of classification. At present I do not know of any better one than that introduced by Bertillon, namely, to rate the household according to whether it keeps no servant, one servant, two servants, or three or more servants.

I need not occupy your time in discussing the importance of considering all these various circumstances, in the study of the great problem of the health officer, namely, What are the principal causes of disease and death

in the locality of which he has charge, and what are the best means of removing or destroying those causes? But while every one is aware of the necessity of considering each of these circumstances separately, in relation to the number of deaths recorded, the importance of their combinations in such a study does not seem to me to be sufficiently generally appreciated, if I may judge from a comparison of the various forms of annual reports which are in use. To show you some of the results of such a comparison, I have prepared a table, showing, for certain states and cities, the classification of data in regard to deaths given in their annual reports. In this table the mark × signifies that the data given in the table relate directly to the particular circumstance or combination of circumstances indicated in the column on the left. The circle indicates that the information is contained in some other combination, while a blank indicates that the information is not given at all. It needs but a glance at the table to see the great diversity in the forms of reports that are used, and to show that in many of the reports most important information is wanting. The combinations, as you see, may be by two circumstances, by three, four, or five. As a rule, not more than four or five can be combined in one table without making it too unwieldy in size. Of the binary combinations, the most important are sex and ages, cause and ages, and cause and localities, or sanitary units of area. Of the ternary combinations, the most important are cause, sex, and age, and locality, sex, and age. For every combination it is desirable to have a corresponding combination for the living population.

The important question to be answered by the statistician, from the data of deaths and living population in each sanitary unit of area, such as a ward, a county, etc., is, How many persons of each sex, of each age, of each color, died from certain causes, and what is the proportion of such deaths to the number of living population of corresponding sex, age, and color in the same unit of area? It is by no means sufficient to give the total number of deaths of each sex, then of each color, then of each age, etc. Even the binary combinations of these, as shown in the table, are insufficient to furnish the information which is required to determine the nature of the influences which injuriously affect the health in a given locality. Let us suppose, for example, that we are told that in the city of Washington the number of deaths from diarrhœal diseases during the year was much greater in Ward I than it was in Ward II. The question is as to the cause of this difference. The cause might be, first, some difference in the water-supply of the wards,—as, for example, one might get its supply mainly from springs or wells, and the other from the general supply; or it might be due to defective sewerage in one of the wards, or to a greater amount of surface uncleanliness; or, on the other hand, it may be due to differences in the character of the population of the wards,—the one being inhabited largely by negroes, and the other by whites; or the one may have a relatively large number of infants as compared with the other, or it may be due to poverty, producing overcrowding and improper food-supply.

Now, to determine which of these causes has been more especially acting, and in what direction remedial measures are to be applied, we wish to know how many children of each color, black and white, there were living in each ward during the year, and how many children of each color of each year of age under five years of age died from diarrhœal diseases during the year. From these data we can soon obtain answers which will narrow the field of inquiry as to the special causes of the prevalence of this form of disease in one of the wards very greatly, even if we cannot completely answer the question.

A most important factor in mortality statistics is age. Each age is specially liable to certain diseases and injuries, and upon the proportion of persons of certain age groups living, will depend, to a considerable extent, the general mortality rate, and to a still greater extent the mortality rates from special causes. But to obtain from the age data of the dead the full information which they can yield, it is essential to have the corresponding age data for the living population. At present we can only get this, with any approach to accuracy, by means of a United States or a state census,—that is, for most places,—only once in ten years. The so-called "police censuses," which are taken from time to time in cities, are, as usually managed, of little value in determining the number of living population, and give no information as to the age distribution, except as to the number of adult males.

It would not be difficult, however, to obtain from a police census extremely valuable information, not only as to the total number of the living population, but as to the number of infants under one year, and of children under five years of age, with distinction of color and sex, and to do this with but little more expense and trouble than that required for the present imperfect methods. And this is a matter in which a health officer, who is on good terms with the police authorities, may effect a great improvement.

The chief defect in the vital statistics of our cities is, for most of them, erroneous estimates of population, such estimates being almost invariably too great, and thus leading to the reporting of too small death-rates.

The practical objection to the preparation and publication of tables of vital statistics, in the complete forms which I have indicated, is, simply, that they are expensive, requiring much more time and labor to prepare them, and much more expense for their publication, than do the collection and publication of the simple elementary data of which these compound tables are made up. In a city having twenty wards, the deaths in each ward during the year, for each sex, and of each of twenty groups of ages, can be given on a page. If it is to be given for each group of ages for each sex, it will require at least twice this amount of space; and if a total is to be given, as well as that for each sex, it requires three pages. If we add the distinction of say fifty causes of death, these for the twenty wards would give an addition of two pages. But if the number of deaths at each age, of each sex, from each cause, in each ward, is to be shown, it will require three times fifty, or one hundred and fifty, pages to present this data distinctly.

Very few persons who have not practically tried the experiment have any idea of the amount of time and labor required to complete such tables with accuracy, especially where the number of individual items to be classified is large. The method most commonly used in this country is, to take some form of a tally-sheet for each unit of area, and on this tally to mark, in the space reserved for that purpose, either with a pencil stroke or the prick of a pin, the number of cases which come under that particular head. Such tally-sheets, however, if made to include a large number of items, are large and clumsy, and give rise to great liability to error in getting the tally into a wrong square or space. Instead of spreading the tally-squares over one large sheet, a much more convenient form is to use a number of small cards, each relating to a single form of disease, and forming a bundle of such cards or slips for each unit of area. This was the method pursued in compiling the data for the 700,000 deaths reported in the last census.

Practical experience, however, has led those who have had most to do with the compilation of vital statistics to the conclusion that the most rapid and accurate compilation is to be secured by the use of small cards, each one of which is devoted to the data relating to an individual. If we take a card about the size of an ordinary postal-card, it is evident that it is easy to record on it all the data relating to an individual death, and that packets of cards thus prepared can be rapidly distributed by localities, color, sex, age, etc., and then counted. It is not at all necessary that these cards should contain much writing. They need not be accurate transcripts from the original records, and the less writing there is on them the better. The best way is probably to record the data on the card by punching out pieces of various shapes in various parts of the card, and by distinctions in color in the cards themselves. It would be quite possible to have the punching of these cards done by machinery, by simply playing upon keys like those of a piano or a writing-machine, and after the cards had been punched, to have them distributed in various ways, and counted by machinery or by electricity. In fact, a method for doing this last has already been devised, and seems to work very well.

Let us next consider the weekly report. Why should this be published? Not for the information of the health officer certainly, for he has the information before it is sent to press. It is for the information of the people, as a means of education, and for the creation and maintenance of an intelligent public opinion, of which sanitary officials have so much need, and in the absence of which their warnings and recommendations are too apt to be entirely unheeded. It also serves to fulfil a duty which the health officer owes to the sanitary authorities of other localities, viz., the giving them timely warning of any outbreak which threatens the public health.

Considered as an educational document, it is very important that the lesson which it is intended to teach should be clearly set forth, and this is not to be done by merely giving columns of figures. The significance of these figures should be clearly stated in words; and upon the manner in

which this is done will greatly depend the usefulness of the publication. The best means of diffusing this information is through the daily and weekly secular press, which is always glad to obtain and publish it, if furnished regularly, promptly, and in proper form. A good rule is to furnish it to the press every Saturday afternoon, closing the record at noon that day.

The chief points of interest for this report are the total number of deaths from all causes, with distinctions of color, sex, age, and locality; the number of deaths from certain specified causes, and, if there is a system of registration of contagious diseases, the number of cases of each of these forms of disease, with distinction of color, sex, age, and locality; the number of births, with distinction of color, sex, and locality, and certain ratios to permit of drawing comparisons. It is not desirable in these weekly reports to attempt to give the number of deaths from each individual cause, or from a large number of causes, and such an attempt is one of the most usual mistakes made in this work. The following are the causes of death which should be specified, and as a rule no others should be referred to in a weekly report: Asiatic cholera, yellow fever, small-pox, typhus fever, enteric fever, relapsing fever, scarlatina, diphtheria, croup, measles, whooping-cough, malarial fever, erysipelas, puerperal fever, diarrhœal diseases (including diarrhœa, dysentery, cholera morbus, and cholera infantum), cancer and tumors, phthisis pulmonalis, other forms of tubercular disease (including tubercular meningitis or acute hydrocephalus, scrofula, and tabes mesenterica), pneumonia, other acute lung diseases, old age, childbirth, stillbirths, accidents, homicides, and suicides.

The units of area for which these are to be reported should, as a rule, be the wards of the city; but to this rule there should be some exceptions. In the first place, it sometimes happens that the ward lines are fixed for purely political purposes, enclosing extremely irregular areas, having no relation to topography. This, for instance, is the case with the present wards in the city of Baltimore. In such a case the ward divisions are absolutely useless for the purpose of the sanitarian and statistician, and should be abandoned, the health officer making his own divisions in accordance with the topography and the character of the population. In such a case he should endeavor, when a census is taken, whether this be done by the city, state, or United States authorities, to have the results of such census furnished him in a form corresponding with the divisions which he has adopted.

It is often desirable for special purposes in certain localities, and for a short time, to make use of smaller units of area than the ward, that is, to give the number of cases of and deaths from certain diseases in a certain square or block, or in the vicinity of certain slaughter-houses, hospitals, or other establishments which may be suspected of exerting a deleterious influence on the public health; and in some cases the publication for a few weeks of the death record of a particular tenement-house or foundling asylum will interest the public, and have a good effect.

The distinctions of color and sex required are self-evident, and call for no remark.

The distinctions of age most useful for the weekly report are as follows:

Under one month,
Under one year,
Under five years,
5–15, 15–25, 25–45, 45–65, over 65;

and of these, the first three and the last are especially important to the sanitarian.

The statement of the weekly report that is made up for study by the health officer should show for each unit of area, and for the whole city, the total number of deaths at each period of age, for each sex, of each color, and it should also show for each unit of area, and for the whole city, the number of deaths from certain causes at each period of age, for each sex, of each color, and the number of cases reported of certain forms of contagious disease with the same distinctions. It is also well to compare the figures of the week with those of several preceding weeks, and with those of the corresponding week in previous years.

It does not necessarily follow that the publication should be made with all this detail;—the publication should contain the conclusions drawn by the health officer from a study of the above figures, with so much of the figures themselves as may seem desirable to justify or enforce such conclusions.

Let us now, in the light of these preliminary remarks, consider some of the weekly forms of reports actually employed. The weekly return issued by the Registrar General of England includes the deaths in London and in twenty-seven other large towns, and forms ten pages octavo. The summary given in the text is, in many respects, a model for such writing. Taking that portion which relates to London, we find the following data given, viz.: Population, estimated to the middle of the year; total number of births and of deaths; number of deaths under one year and over sixty years; number of deaths from small-pox, measles, scarlet fever, diphtheria, whooping-cough, fever, diarrhœa, violence, inquest cases, in public institutions, unknown causes; the annual rate per 1,000, and a series of meteorological statistics. In a second table are given the births and deaths registered during the week and in the corresponding week for ten preceding years, with distinction of sex; also the births, deaths, and meteorology for the preceding thirteen weeks, the deaths being given with certain distinctions of age, and also of color and cause. Next comes a table of the deaths from all the principal causes, with distinction of seven groups of ages. Then a table is given, showing for each sub-district in London the facts indicated in the first table described above, with the omission of the meteorological statistics; and, lastly, tables are given showing the death-rate in foreign cities, and giving an elaborate *resumé* of meteorological observations.

The weekly return for Dublin and other Irish towns is somewhat more

extended and elaborate than the English report. The weekly return for the eight principal towns in Scotland is much simpler and briefer, covering only two pages octavo, and including only the items mentioned as given in the first of the English tables.

Paris.—The weekly bulletin of Paris is a folio sheet of five pages, and gives an extended series of tables of deaths, in which the principal causes of death in relation to age, and in relation to the several districts of the city, are included. There is also given a diagram of the city, with its subdivisions, in each of which the number of deaths from certain diseases are indicated. This diagram is an excellent feature of the Paris report. A similar one is given in the weekly report of Lisbon.

Brussels.—The weekly bulletin of Brussels, issued by Dr. E. Janssens, is in many respects a model, as we might expect from the name of its author. The data for Brussels occupy one page of a small folio sheet, and are arranged in three tables.

The first of these gives for each day of the week the births (indicating legitimacy) and deaths by sex, the marriages, and a meteorological summary; and for each of these factors, a proportional comparison with the preceding week, and the corresponding week of the preceding year. The deaths of strangers are separately indicated in the table. The next table records the deaths of residents by sex and groups (13) of ages, and the stillbirths and deaths under five years by sex and legitimacy. The third table gives, for the city proper, in six subdivisions, and for each of the eight suburbs, the population, the births, and the deaths by causes in twenty-one groups.

Lisbon.—The weekly report of Lisbon, four pages folio, records the population according to the last enumeration. The first table contains the daily births and stillbirths by sex and legitimacy, the daily deaths by sex, and a comparison of these factors with the preceding week, and the corresponding week of the preceding year. The second table gives a meteorological summary; and the third, the deaths by groups (16) of ages and legitimacy. The fourth table gives by parishes (34) the population and deaths by causes (42). The last page of the report contains a map of the city, indicating the parishes, and the frequency of deaths from zymotic diseases in each parish.

Genoa.—The report of Genoa, eight pages folio, gives the calculated population; marriages by previous civil condition, by consanguinity; births and stillbirths by sex, legitimacy, and by wards, and by residents or strangers; causes (167) of deaths by sex, and groups (11) of ages, by sex and civil condition, by sex and domiciles, by sex and residents and strangers; deaths by occupations (123) and meteorology of the week; vaccination.

Other matters besides vital statistics are sometimes included in the weekly reports. Thus, in Dresden, the height of the ground water at various points is given, also the number of cattle brought to market, and the market prices of various articles of food. The Genoa report gives the dog-catchers' record.

New York city.—The weekly report of New York city, eight pages quarto, gives the estimated population; daily deaths by causes (45); daily deaths of children under one, two, and five years; deaths by causes (45) and groups (20) of ages; deaths by sex and causes, by color and causes; deaths from zymotic diseases by wards; births, by color, by sex, by nativity of parents; marriages, by color, by nativity, and by civil condition (1st, 2d, 3d, &c., marriage); deaths, births, marriages, and stillbirths by nativities; stillbirths by sex, by color, and by period of utero-gestation; and deaths by nature of domicile.

Brooklyn.—The weekly report of Brooklyn, in four pages quarto, gives the population estimated at the middle of the year; the area and number of houses; the daily deaths by causes (24); the deaths by causes and groups (8) of ages; the deaths by sex, by nativity, and the deaths from zymotic and from other specified diseases by wards; deaths by civil condition in public institutions; deaths, births, and marriages by nativities; stillbirths by sex, parentage, and by periods of utero-gestation; also births and deaths and meteorology for the preceding thirteen weeks.

New Orleans.—The report of New Orleans, in three pages quarto, gives the estimated population by color; deaths by causes (292) and color; deaths by groups (16) of ages, sex, and color; deaths by nativities; deaths in public institutions: stillbirths by sex and color; and the meteorology of the week.

The weekly report issued by the Imperial Board of Health of Germany was, until recently, a folio sheet of four pages, in which appendix sheets were inserted occasionally. It is now an octavo of twelve pages, several pages being devoted to a summary statement of the results shown by the tabulations for the week, which is that ending ten days previous to the date of issue. The second page is occupied with a table showing, for cities of 40,000 inhabitants and upward, the following, viz.: Population; number born alive; number born dead; deaths, exclusive of stillbirths, and with distinction of deaths of infants under one year; annual mortality rate; average annual rate for the preceding five years; number of deaths from each of nine causes or groups of causes of death. Supplementary tables are given for cities of 15,000 inhabitants and upwards.

If my views as to the proper scope and function of these documents are correct, the majority of the weekly reports now issued as separate printed documents by cities, both in this country and abroad, attempt to embrace more than can be conveniently included in this form of report without causing considerable delay in its issue, thus defeating one of its objects. It seems to me that where there is not an ample clerical force and a superabundance of funds for purposes of publication,—and this I fear is the case in most municipalities,—it is better to make the separate bulletin a monthly rather than a weekly one, and to rely on the public press for the publication of the weekly reports. When this is done, the importance of a prompt appearance of the monthly bulletin is not so great

as in the case of a weekly one, and time can be taken for properly completing the data for each month, and for presenting them in considerable detail. The forms to be used in the office for the compilation of such monthly reports should be in the main those required for the annual report, in order that the latter may be conveniently and readily prepared by merely summarizing the former. It is not meant by this that all the data thus compiled are to be published in the monthly report; but that it will be found most convenient to have the compilations for the annual report brought up to date at the end of each month.

Statistical reports of disease, or morbility statistics, can, as a rule, only be obtained for a few of the contagious or spreading diseases, with regard to which compulsory notification is enforced. The exception to this rule occurs in the army and navy, and in the police force of some cities, where all cases of excuse from duty are recorded, with the cause of the exemption. The reports of prevailing diseases, published by the Michigan State Board of Health, are statistics of the opinions of physicians as to the relative prevalence of certain forms of disease, and not of the actual number of cases. Where there exists in a city a system of compulsory notification of cases of contagious and infectious disease, the number of cases of each kind of disease should be reported weekly, with distinction of sex, color, ward, and of age.

There are sometimes great difficulties in the way of doing this, owing to the pressure which commercial interests exert upon the health authorities or registrar, and on the public press, to prevent the publication of what seems likely to injure the business interests of the city. Unless one has had some personal experience of the intensity and the magnitude of this sort of pressure, he cannot estimate the difficulty of resisting it.

Nevertheless, the attempt to conceal the extent of prevalence of an epidemic in a city is always a short-sighted policy, because it gives rise to exaggerated rumors as to the amount of disease present, and thus really tends to increase rather than to allay panic in neighboring communities. Moreover, when it is discovered that a health officer has attempted to conceal this kind of information in one instance, he becomes an object of suspicion to other sanitary authorities; and his statements, though truthful, are not believed. I think that his wisest course in all cases is, to furnish the press with full and accurate reports of prevailing sickness and deaths, so far as he has the data to do so, and thus avoid the responsibility of concealment.

There are several sources of information with regard to the amount and character of disease prevailing in a city, of which the health officer can, with a little tact and management, avail himself, and which, it seems to me, are too much neglected. There are the public dispensaries and other institutions for the treatment of the sick, including the city physicians to the poor, the prisons, reformatories and asylums, and the public schools. From all these,—certainly from all of them which are supported from the public funds,—he should be able to obtain reports showing the number and character of the diseases coming under their notice.

Thus far I have been speaking with special reference to municipal statistical reports. As regards state reports, the chief differences are those connected with the unit of area or locality to be made use of. This will be, as a rule, the county. In the case of a city, it will be desirable to give its data separate from those of the county in which it is situated. The number of counties in most states is too large to permit of giving for each county the deaths by cause, age, sex, color, etc.; and therefore some selection must be made as to the information to be given for each county, reserving the more complete tabulations for either the whole state, or for what, in some cases, will be better, certain groups of counties, which may be formed from topographical considerations.

The data which were selected to be given for each county, in the vital statistics of the last census, are the following, viz.:

Number living at date of census,	
Born and died in the census year,	
Total births during the census year,	
Deaths per 1,000 during census year of those born within the census year,	Under 1 year of age.
Deaths,	
Deaths in 1,000 of living population,	
Number living at date of census,	
Deaths,	Under 5 years of age.
Deaths in 1,000 of living population,	
Deaths under 5 years in 1,000 deaths at all ages	
Population,	
Deaths,	All ages.
Rate per 1,000,	
Scarlet fever	
Enteric fever,	
Malarial fever	
Diphtheria,	
Croup,	
Diarrhœal diseases,	Deaths from certain specified causes.
Consumption,	
Pneumonia,	
Heart disease and dropsy,	
Childbirth,	
Old age,	
Still-born,	

The principles upon which counties should be grouped in accordance with their relations to altitude, vicinity to large bodies of water, drainage areas, etc., are illustrated in the groupings adopted by the Massachusetts and New York state boards of health in their monthly bulletins, and also by those made use of in the last United States census.

The mode in which registration is effected in most of those states which have any system of registration is such that they can only make annual reports of deaths. In a few states monthly bulletins are possible, and these should be framed upon the same principles as those which have been indicated as applying to municipal weekly reports.

It will be observed, that, although I have used the term "vital statistics" occasionally, this paper is really limited to the discussion of the tabulation of deaths, *i. e.*, of mortality statistics. This limitation is not due to any want of appreciation of the interest and importance of records of births, but to the fact that, as a rule, the registration of births is not sufficiently complete to permit of obtaining from it deductions which shall be useful in a sanitary point of view.

Where it is possible to obtain fairly complete records of births, the proportion between the number of births, with distinction of sex and color, and the number of deaths of infants, with the same distinction, forms one of the most valuable tests of the healthfulness of a locality, or of a particular season of the year; and this is a test which the sanitary statistician should always use when he can obtain the necessary data.

I may say that I have purposely omitted the recommending of particular forms, sizes, etc., of tables, although, from the comparative tables which I have given, it is not difficult to select those which are most complete. In addition to these, the forms of tables which are recommended by the Society of Medical Officers of Health of England should be studied. It appears to me that a conference between the officers having charge of the publication of vital statistics in those cities and states which have a system of registration, and which publish the results, might lead to more uniform methods of presenting these important data to the public than at present prevail; and that this association would do well to take the initial steps towards having such a conference.

In conclusion, I wish to call attention to the importance of graphic representations of the results of studies of vital statistics, in the form of diagrams and cartograms. It is true that such illustrations are somewhat costly, and that in one sense they add nothing to the information which may be derived from the tables from which they are compiled; but they are an extremely important means for the diffusion of this knowledge for educating the people as to the value and uses of vital statistics. Such education is now of prime importance to all who are interested in sanitary matters: it is in fact a necessity, if we are to make substantial progress in preventive medicine.

TABLE SHOWING CHARACTER OF DATA RELATING TO DEATHS IN MONTHLY OR QUARTERLY REPORTS OF VARIOUS CITIES AND TOWNS.

MONTHLY OR QUARTERLY DEATHS BY—	Milan.	Savannah.	Mobile.	Dist. Columbia.	Nashville.	Detroit.	Milwaukee.	St. Louis.	Providence.	Chicago.	Brussels.	Knoxville.	Boston.	Minneapolis.	New Haven.	Lubeck.	Montreal.	Burlington.	Buenos Ayres.	England.
Sex	...	o	o	o	o	o	o	o	x	x	o	o	x	x	o	o	x	x	x	...
Age	o	o	x	o	x	o	o	o	x	x	x	o	o	o	o	o	...	x	x	...
Color	...	o	o	o	o	...	...	o	x	x	...	o	x	...	...	...	...	x	x	...
Locality	x	...	x	o	...	...	x	...	x	x	o	...	...	x	x	o	x	...	...	x
Cause	x	o	o	o	o	x	x	o	x	x	o	o	o	o	x	o	x	x	x	x
Birthplace	...	...	...	o	x	x	x	x	x	x	...	x	x	x	x	...	x	x	x	...
Parentage	...	...	...	...	...	...	...	...	x	x	...	...	...	...	...	...	...	...	...	...
Occupation	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Civil condition	o	...	o	o	o	o	o	o	x	x	...	o	x	x	o	...	x	...	...	...
Sex. Age	...	o	...	o	...	o	o	...	...	...	...	...	...	...	x	x	...	...	...	...
Sex. Color	...	o	o	o	o	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...
Sex. Locality	...	...	...	...	...	...	...	...	...	...	x	...	...	...	...	x	...	...	...	...
Sex. Cause	...	o	...	o	o	...	...	x	...	...	...	...	x	x	...	x	...	...	...	...
Sex. Civil condition	...	...	o	o	o	o	o	...	...	...	...	...	...	...	x	...	...	...	...	...
Age. Cause	o	o	...	x	...	...	...	x	...	...	...	...	x	x	...	...	...	...	...	...
Age. Color	...	o	...	o	...	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...
Age. Civil condition	x	...	...	...	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...
Color. Locality	...	...	...	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Color. Cause	...	o	x	...	o	...	...	x	...	...	...	x	...	...	...	...	...	...	...	...
Color. Civil condition	...	...	o	o	o	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...
Locality. Cause	...	...	...	...	...	...	...	...	...	x	x	...	...	...	...	...	...	...	...	...
Cause. Birthplace	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cause. Parentage	...	...	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...
Cause. Civil condition	o	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Color	...	x	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Civil condition	...	...	...	...	...	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Color. Cause	...	...	...	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Color. Birthplace	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Color. Civil condition	...	...	x	x	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Color. Cause	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Age. Cause. Occupation. Civil condition.	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

TABLE SHOWING CHARACTER OF DATA RELATING TO DEATHS IN YEARLY REPORTS OF VARIOUS STATES AND CITIES.

YEARLY DEATHS BY—	United States 1880.	United States 1870.	Kentucky.	Connecticut.	Alabama.	Baltimore.	New Orleans.	Charleston.	Brussels.	Michigan.	Rhode Island.	Vermont.	Massachusetts.	Indiana.	England.	Leghorn.	Minneapolis.	Philadelphia.	New York.	Wilmington.	Georgia.	New Jersey.
Sex	x	o	o	o	o	o	o	o	o	o	x	o	o	o	o	x	o	x	o	o	o	o
Age	x	o	o	o	o	x	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Color	x	...	o	o	o	o	x	o	...	o	...	...	...	o	...	...	...	x	o	x	o	...
Locality	o	o	x	o	x	o	...	...	x	o	o	o	o	o	o	...	o	o	x	...	o	x
Cause	o	o	o	o	x	x	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
Month	o	o	o	o	x	o	o	o	...	o	o	o	o	x	...	...	...	x	o	o	o	o
Occupation	...	o	...	o	...	...	...	...	o	...	o	x	x	...	...	...	...	...	...	...	o	...
Birthplace	o	...	...	o	...	o	o	x	...	x	...	...	o	o	...	...	...	o	o	x	o	...
Parentage or race	o	o	...	o	...	...	...	...	...	...	x	...	...	...	...	...	...	...	x	...	...	...
Civil condition	...	...	o	...	...	...	...	...	o	...	...	...	...	o	...	o	o	...	x	...	o	...
Sex. Age	x	o	...	o	o	...	o	...	o	x	o	o	o	o	x	o	...	...	...	...	...	...
Sex. Color	x	...	o	o	o	o	o	x	...	x	...	...	...	o	...	...	...	...	...	...	...	...
Sex. Locality	x	x	o	x	...	...	...	...	...	o	x	x	x	x	x	...	...	...	...	...	x	...
Sex. Cause	o	o	o	x	x	...	...	...	o	x	x	o	x	x	o	o	x	x	x	...	...	...
Sex. Month	o	o	...	o	o	o	o	...	...	x	o	o	x	o	...	...	...	x	...	x	...	x
Sex. Civil condition	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	x	...	...	...	...	...	...
Age. Color	o	...	o	...	o	...	o	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Age. Locality	x	o	x	o	...	...	...	...	...	...	x	o	o	...	x	...	...	...	...	...	x	x
Age. Cause	o	o	...	x	x	...	o	...	o	o	o	o	x	x	o	o	x	x	x	...	...	...
Age. Month	o	...	...	...	x	x	...	...	...	x	...	...	x	...	...	...	...	...	...	x	...	x
Age. Occupation	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Age. Parentage	x	o	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Color. Locality	o	...	o	o	x	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	x	...
Color. Cause	o	...	o	...	x	...	o	o	...	...	...	...	...	x	...	...	...	x	x	...	...	...
Locality. Cause	o	o	o	x	...	...	...	...	x	x	x	x	x	...	x	...	x	x	x	...	x	x
Locality. Month	o	o	o	o	x	x	...	...	...	o	o	o	o	o	...	...	...	...	...	...	x	...
Locality. Occupation	...	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	x	...
Locality. Birthplace	o	o	...	x	...	...	...	...	...	o	...	...	x	...	...	...	...	...	...	...	x	...

Locality.	Parentage				x	x		o							x											
Locality.	Civil condition						x																		x	
Cause.	Month				o	o	o	x	x	x	o	o		x	o	o	x	x					x	x		
Cause.	Occupation					o							o		x											
Cause.	Birthplace				o	o					x							x				x	x			
Cause.	Parentage				x	o									x											
Cause.	Civil Condition												x					x			x					
Month.	Birthplace				o					o	x															
Sex.	Age.	Color			x						x															
Sex.	Age.	Locality			x	x		o							x	x	x									
Sex.	Age.	Cause			x	o							x	x	x	x	x	x	x	x						
Sex.	Age.	Month			o									x												
Sex.	Color.	Locality			x		o	x						x												
Sex.	Color.	Cause			o		o											x								
Sex.	Color.	Month							x	x	x															
Sex.	Locality.	Cause			o	o	o	x											x							
Sex.	Locality.	Month			o	x		x						x	x	x	x	x								
Sex.	Locality.	Birthplace												x												
Sex.	Locality.	Parentage			x																					
Sex.	Cause.	Month			o	o								x	x	x	x									
Sex.	Cause.	Occupation											x													
Sex.	Cause.	Parentage			x																					
Age.	Color.	Cause			o						x															
Color.	Locality.	Month							x																	
Color.	Cause.	Month									x	x														
Color.	Month.	Birthplace								x																
Locality.	Cause.	Month			o	o	x																			
Locality.	Cause.	Occupation				x																				
Locality.	Cause.	Birthplace			x	x																				
Locality.	Cause.	Parentage			o	x																				
Sex.	Age.	Color.	Cause		x				x																	
Sex.	Age.	Locality.	Cause		x	x																				
Sex.	Age.	Locality.	Parentage		x	x		x																		
Sex.	Color.	Locality.	Cause		x		x																			
Sex.	Locality.	Cause.	Month		o	x																				
Sex.	Age.	Color.	Locality.	Cause	x																					
Sex.	Age.	Locality.	Cause.	Month	x																					
Sex.	Age.	Locality.	Cause.	Parentage	x																					

TABLE SHOWING CHARACTER OF DATA RELATING TO DEATHS IN WEEKLY REPORTS IN VARIOUS CITIES AND TOWNS.

WEEKLY DEATHS BY—	Dresden.	Paris.	Genoa.	Brussels.	New Orleans.	Cleveland.	Brooklyn.	Dublin.	London.	Reims.	New York.	Charleston.	Nancy.	Rome.	Philadelphia.	Baltimore.	Massachusetts, ten towns.	Germ'n t'wns, 15,000 inhabitants.	Twenty-eight English towns.	Eight Scotch towns.
Sex	o	x	x	o	o	o	o	x	x	x	o	...	...	o	x	x	...	...	...	...
Age	o	o	o	o	o	o	o	o	x	o	o	o	x	o	x	x	x	x	x	x
Color	...	...	...	...	o	o	...	...	...	...	o	o	...	...	...	...	...	...	...	...
Locality	o	o	o	o	...	o	o	o	o	o	...	...	x	x	x	x	...	...	...	...
Cause	o	o	o	o	o	o	o	o	o	x	o	o	x	o	x	x	x	x	x	x
Occupation	...	...	x	...	...	...	...	o	...	...	...	...	...	...	...	...	...	...	...	...
Birthplace	...	...	o	...	x	o	o	...	...	...	...	...	...	...	x	x	...	...	...	...
Civil condition	...	...	o	...	...	o	...	o	...	...	x	...	...	...	...	...	...	...	...	...
Legitimacy	o	o	...	o	...	...	...	...	...	o	...	...	o	...	...	...	...	...	...	...
Domicile	...	...	o	...	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...
Sex. Age	o	x	...	o	o	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Cause	o	o	...	...	...	x	x	...	...	...	x	...	...	x	...	...	...	...	...	...
Sex. Birthplace	...	...	o	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Age. Color	...	...	...	...	o	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...
Age. Cause	o	o	x	...	...	x	x	x	x	...	x	...	...	x	...	...	...	...	...	...
Age. Occupation	...	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...
Age. Civil condition	...	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...
Age. Legitimacy	o	...	...	o	...	...	...	...	...	x	...	...	x	...	...	...	...	...	...	...
Color. Cause	...	...	...	...	x	x	...	...	...	...	x	x	...	...	...	...	...	...	...	...
Locality. Cause	x	x	...	x	...	x	x	x	x	x	...	...	...	...	...	...	...	...	...	...
Cause. Birthplace	...	...	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...
Cause. Civil condition	...	...	x	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cause. Domicile	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Color	...	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Cause	o	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Legitimacy	...	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Locality. Birthplace	...	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Locality. Legitimacy	...	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sex. Age. Cause. Legitimacy	x	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

IX.

IMPURE AIR AND UNHEALTHY OCCUPATIONS AS PREDISPOSING CAUSES OF PULMONARY CONSUMPTION.

By C. W. CHANCELLOR, M. D., Secretary State Board of Health, Maryland.

Consumption is a destroyer which, "like a worm i' the bud, feeds on the damask cheek," and lays in an early grave more people than any other disease.

It is calculated that in England one fifth of all the deaths occurring are from pulmonary consumption; in France, one sixth; and in Germany and Austria, about one seventh. The number of deaths recorded and tabulated, as occurring in the United States during the census year of 1880, was 756,893, and of this number over twelve per cent., or about one eighth, were from consumption. If, then, one eighth of all who die in this favored country are carried to their graves by *phthisis pulmonalis*, the causes which lead to this fearful mortality demand more than ordinary consideration.

We know that want of light, and a humid, impure atmosphere, have an influence in the production and development of tubercles; but there are other predisposing causes, such as a want of nutritious food and proper clothing, unhealthy occupations, luxurious habits, fashionable dissipations, and hereditary physical imbecility, which should not be lost sight of.

Experiments made upon rabbits show that these animals, when confined in a dark, damp room, and deprived of proper food, will develop tubercles not only in the lungs, but in other organs of the body. In the human family tubercles are not confined to the lungs, but they are most frequently found there. That they may be formed, and afterward remain dormant and harmless throughout life, is clearly established by the case of the late Dr. Joseph Parrish, of Philadelphia.

When about twenty-five years of age, Dr. Parrish was affected with a severe and lasting cough, and considered himself in danger of pulmonary consumption, to which he believed he had a family predisposition, having lost a brother and a sister by that complaint. Under a course of vigorous exercise in the open air, without the use of medicines, he ultimately surmounted the threatening symptoms, and finally died of Bright's disease, at the age of sixty-one years. The existence of well defined cicatrices in the upper portion of both lungs, discovered upon *post mortem* examination, proved that his apprehensions were well founded, and at the

same time affords strong evidence in favor of the plan of treatment which he adopted in his own case, and always strenuously advocated.

In this paper it is proposed to discuss only the effects of impure air and unhealthy occupations in the production and development of pulmonary consumption.

Pure air is as essential to the health and vigor of the animal system as wholesome food and drink. When contaminated by stagnation, by breathing, by fires, or by artificial lights, such as candles, lamps, and gas, it operates as a slow poison, and gradually undermines the human constitution; yet nothing is less attended to in the economy of health by the great majority of mankind. Because air is an invisible substance, and makes little impression upon the organs of sense, people seem to act as if it had no existence. Hence we find that very little attention is paid, especially by the humbler classes of society, to the proper ventilation of living apartments. In some cases the windows are so fixed in the walls as to be incapable of being opened; and in other cases, where the windows are movable, they are seldom opened, except by accident, for weeks and months together; and were it not that a door and chimney are to be found in every habitable apartment, the air would be rendered, in many instances, absolutely unfit for respiration.

Crowds of tailors, seamstresses, weavers, shoemakers, and other persons employed in sedentary occupations, are frequently pent up from morning until evening in close and sometimes damp apartments, without ever thinking of opening their windows for a single half hour for the admission of fresh air; consequently, they are continually breathing an atmosphere impregnated with the noxious gas emitted from the lungs, and the effluvia perspired from their bodies, and which is most sensibly felt by its hot, suffocating smell when a person from the open air enters such apartments. The sallow complexions of the occupants plainly indicate the enervating effects produced by the air they breathe; and, although the pernicious effects may not at first be sensibly felt, it gradually preys upon their constitutions, and often produces incurable consumptions, which are frequently imputed to other causes.

It cannot be denied that some occupations are more unhealthy than others; yet health is denied to no man;—but Hygiea's rules are exacting, and must be closely, nay, rigidly, followed. They have a close relation to the physical, the organic, the intellectual, and the moral laws, and cannot be broken or trampled upon without physical suffering, and moral or intellectual debasement. It is not intended here to speak of individuals, but of classes. There are men among all professions and trades, who live temperately, enjoy life rationally, and arrive at a good old age; but in all classes there are those of an opposite character.

There can be no doubt that the inhabitants of cities are less hardy and more subject to pulmonary disease than those of the country. The former, speaking generally, are pale, of lymphatic temperament, and their muscular systems are but poorly developed. The want of a free circulation of pure, uncontaminated air is the most powerful cause of this.

In certain localities in the country, as on the sides of mountains with a south south-west exposure, the inhabitants are generally muscular, well grown, robust, and healthy; whereas, in north north-east exposures, not well open to the sun, or in cloudy, humid valleys, we find them for the most part weak, rickety, and subject to scrofula and consumption.

Dry and elevated situations exhibit inhabitants less robust than those of the mountains, but they are active and healthy. On the other hand, in low, damp, and shaded places, and along the borders of large rivers, men have their muscular apparatus but little developed. They are generally weak, often sick, and seldom attain an old age.

To the enervating agencies already mentioned as existing in certain localities in the country, we may add other noxious influences which are almost peculiar to city life. We find that in cities the passions are more excitable; indulgence in eating and drinking is more common; with many life is more sedentary; and the occupations are altogether more unhealthy. Take, for example, those engaged in mercantile life—merchants and clerks. These, for sanitary purposes, may be divided into three classes:

1. Those who have but little exercise, such as book-keepers;
2. Those who have exercise, but are confined to their stores in a superheated, unhealthy atmosphere, as, for example, salesmen;
3. Those who have exercise in the open air, or who do out-door work.

These three classes are subject to many diseases in common; but each may be considered as coming more directly under the influence of causes which are calculated to produce, in each, diseases in a certain set of organs. For example, one class have but little exercise, and their digestive organs suffer; another suffer from diseases of the pulmonary organs; the third suffer from the prostrating effects induced by over-mental or bodily exertion, or by corroding care.

In this paper we have to treat only of the third class, or those who suffer from diseases of the pulmonary organs. Salesmen are liable to these diseases because they are constantly exposed to their exciting causes, the principal of which are an impure atmosphere, and exposure to sudden changes of temperature and sudden abstractions of heat, the effect on the body being to close the pores of the skin, to diminish the calibre of the small vessels, and to drive the blood in greater force and quantity to the lungs, which is followed by irritation and inflammation. If tubercles exist, they are involved in the difficulty, and soon proceed to their work of destruction.

Many a salesman has fallen a victim to consumption in the following way: He is, during cold weather, confined in a store-room badly ventilated, and possibly at a temperature of 80° or 85°, and has been exercising freely in waiting upon some customer. He is called out suddenly—is in a hurry, and does not stop to put on an overcoat, but goes out into the cold air, the temperature of which is probably 40° or 50° lower than that in the store. His stay in the cold air may be somewhat protracted, and he returns feeling chilly. He finds the next day that he has taken

cold, attended with a little cough, to which, however, he pays no attention, but goes on exposing himself time after time, until eventually the hectic flush, the night sweat, and the debilitated frame compel him to withdraw his attention from the cares and turmoils of the busy world, and lead him to think of the sad blow he has given to his physical powers, and the means he must use to restore them to their original strength and harmony.

Let us now turn our attention to artisans and laborers who work in manufactories and shops, many of which are badly located, badly ventilated, and often abounding in unhealthy dust. Under such circumstances, the most active exercise, the most substantial nourishment, the most temperate habits, cannot prevent their becoming blanched and weakened by disease.

Nearly all trades and manufacturing processes are attended by the evolution of dust, or of volatile particles more or less considerable, and more or less hurtful. Persons habitually breathing a dust-laden atmosphere of this kind acquire a liability to diseases of various sorts; but as the inhaled dust is necessarily, in every instance, brought in contact with the lungs, it is accordingly the pulmonary organs that chiefly suffer in the end. Were we to enter one of the busy workshops of the steel-workers, and for a time, amid the turmoil of machinery, attempt to breathe its stifling atmosphere, charged with minutely pulverized dust emitted by hundreds of wheels, we would have a practical experience of the reason why few, if even one, of all the workers there will ever reach their fortieth year.

The average duration of life among the dry-grinders of forks is twenty-nine years; of razor-grinders, thirty-one years; edge-tool-grinders, thirty-two years; knife- and file-grinders, thirty-five years; and saw- and sickle-grinders, thirty-eight years. The cause of this excessive mortality is apparent. In every hundred sick among the needle-makers, seventy are consumptive; among the file-makers, sixty-two in a hundred are consumptive; and taking the steel-grinders all round, rather over forty in the hundred are consumptive. Consumption among workers in copper and lead is the predominant disease; and in every one hundred lithographers, for instance,—workers in copper,—one half nearly are consumptive.

But notoriously overtopping all the other dusty occupations in their effects upon life and health are those of the grindstone-makers, flint-cutters, and glass-polishers. The condition under which their work is carried on is in the highest degree favorable to the production of pulmonary diseases. They work in an atmosphere loaded with sharp spiculæ, which lacerate the lungs, and quickly induce consumptive disease. Every grindstone-maker is cut down by it at, or soon after, the age of twenty-four. Hardly one escapes. The flint-cutter and glass-polisher have each eighty deaths per hundred sick of consumption, and their average life is under thirty years. Again: The stone-cutters terminate their average life at the age of thirty-six, thirty-eight in every hundred sick being consumptive.

The occupations which are productive of vegetable dust include a somewhat promiscuous and apparently incongruous variety of workers. Among these we have the cigar-maker and the tobacco and snuff worker. Although they enjoy an average life of fifty-five years, they, nevertheless, head the list with thirty-six cases of consumption in every hundred. Among the different classes of workers in textile fabrics, the weavers engaged in the cotton, flax, and hemp branches are unquestionably the chief sufferers. It is stated on the best authority that three fifths of the flax-mill workers of Belfast, Ireland,—the chief centre of that textile manufacture,—are consumptive. In other words, sixty in every hundred are said to die of that disease. The average life of the weavers of this restricted class is forty-four years, while that of weavers in general is about fifty-seven. Carpenters, joiners, and cabinet-makers are affected by their dusty occupations, each group having fourteen consumptive cases in every hundred. It is generally believed that the coal miner's and coal heaver's occupation is one most highly productive of pulmonary disease; and on that supposition, when consumption occurs in this class, it is designated "miner's phthisis." Dr. Smart says that in his experience—hospital and otherwise—he had not been able to confirm this prevalent belief, nor does he believe it to be well founded. In every case of so called "miner's phthisis" which he had seen, there was a distinct family history of the disease. It would seem, therefore, that a man predisposed hereditarily to consumption develops it not more readily as a coal miner or coal heaver than in any other employment. The black expectoration seen in miner's consumption proves no more than that the coal dust has reached the lungs, certainly not that it is the cause of the disease. Coal dust, or to call it by its proper name, carbon, from its highly antiseptic properties, acts as an excellent protection to the pulmonary organs. Dr. Smart further states that among twelve hundred sick miners, only one case of consumption was noticed.

The effect of breathing animal dusts is shown in the following statistics: The percentage of consumption among brush-makers is 49.1; hair-dressers, 32.1; skinners, 23.2; tanners, 16.2; hatters, 15.5; button-makers, 15; harness-makers, 12.8; cloth-makers, 10 per cent.

Constrained bodily position will also induce asthmatical and bronchial affections. Needle-women of every class, tailors, and shoemakers suffer from consumption in a nearly equal degree. The tailors and needle-women have each nineteen deaths from consumption per hundred sick. The shoemakers fall short of that number only by a fraction, being 18.7 per cent.

In the face of an evil of such increasing magnitude, it behooves the sanitarian and the humanitarian, the Christian and the philanthropist alike, to seek some means of preventing these terrible effects of unhealthy occupations. The problem to be solved is, simply, how to environ each worker in the prosecution of his work with a pure atmosphere. The solution of the problem could be easily suggested by the sanitary engineer, but its execution is a matter for which the responsibility rests upon the

legislatures of the several states. The result appears to be only a question of certain simple, practical, mechanical adjustments, requiring no effort of genius, or even outlay, where there is already the existing machinery of a state board of health. In the mean time those who are seeking for help must be cared for; and it is, therefore, extremely desirable, and even necessary, that consumptive hospitals should be established in every city. London has its half dozen hospitals for consumptive cases, and other considerable cities in Europe are not without some provision for them; but in this country, even in many of the larger cities, there is no provision made for so necessary an object. It would be a great and truly useful work to devote an edifice in every large city to so benevolent a purpose; and to the good Samaritans who shall do so there will be the reward, not of the approbation of their countrymen, or the lasting gratitude of those who may reap the benefits, but the enviable consciousness of a deed that will afford relief to a sadly numerous and helpless class of sufferers.

X.

THE VIRUS OF HOG CHOLERA.

By D. E. SALMON, D. V. M.,
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Of all the contagious diseases which affect the domestic animals of this country, there are none which are disseminated over a greater area of territory, and none which destroy more property, than that plague of swine which is popularly called hog cholera. During the present year its ravages have been unusually widespread and severe. It has found its way into nearly every state, and when the losses in the various sections of the country are added together, we shall probably find that the aggregate is not less than $25,000,000, and it may reach $30,000,000.

While it has never been shown that this malady may be transmitted to the human species, there are many reasons why it is deserving of profound study by all who are interested in questions concerning the public health.

In the first place, the number of dead hogs which result from this disease every year, in this country, reaches into the millions, and some disposition must be and is made of their carcasses. What that disposition happens to be *may* be a matter bearing very directly upon the health of our people. Sometimes these carcasses are left to putrefy in the open air, to be preyed upon by carnivorous animals and birds; sometimes they are thrown into the ponds and streams which furnish drinking-water to our cities; sometimes the lard is rendered from them;—and what finally becomes of this product is an interesting subject for speculation. Exceptionally, they are burned or buried—the most satisfactory termination of their existence.

Again: It seems to be a fact that when this affection breaks out, the owners of swine in the vicinity very often ship their animals to market at once, to escape its ravages. It is even alleged that the still healthy animals in an infected herd are disposed of in the same way. As a result, the disease is often found in the great central stock-yards, from which thousands of animals are taken every day, and killed for packing. Some of these are undoubtedly passing through the period of incubation of the plague; in others the disease may be developing, and, with the most careful inspection, would pass unnoticed. What would be the effect of the meat from such animals upon human health? I suspect that none of us are able to answer this question satisfactorily in the present condition

of our knowledge. The flesh of diseased hogs may be practically harmless, or it may be the cause of some of the obscure maladies which the physician daily meets in practice. To solve these problems definitely, it seems evident that one line of investigation must deal with the virus itself—its nature, its effects upon other species of animals, the period during which it retains its virulence after the death of its host, the durable chemical substances which it may form, and last, though not least, the septic complications which may accompany it.

In the second place, the study of this virus is of peculiar interest to us at this time, because of its bearing upon the general subject of contagion. The science which treats of this important class of phenomena is still in its infancy. A decade has not yet passed since Koch laid a substantial foundation for the germ theory of disease by his remarkable studies of the *bacillus anthracis*, the germ of malignant anthrax or charbon. But charbon is not what we should call a virulently infectious malady. The virus seems to multiply in certain soils, and is taken into the system with the food, and it is exceptional that animals contract it from each other; and when it is so contracted it is by actual contact, and the virus is introduced through wounds of the skin or mucous membrane. In other words, it is rather an endemic and enzootic, than an epidemic or epizootic.

When we consider the great epidemics or epizootics, we find very few, if any, the germs of which have been satisfactorily studied and determined. The pathogenic effects of the cholera bacillus are still questioned, and it seems that the essential test of a pathogenic germ, viz., the production of the malady by inoculation, has not, in this case, been as satisfactory as we could wish. And so with the other epidemic diseases, which I need not enumerate.

Fowl cholera is an example of an animal plague which is in no apparent degree limited by conditions of climate and soil; but, while it is epizootic, it seemed to me, after a long series of investigations, that the virus was not disseminated through the air, even for short distances, and that it was necessary for this virus to be ingested with the food, or inoculated into the tissues, to produce the malady. While, therefore, this affection is unquestionably caused by a micro-organism, we still lack an example of a virulently infectious disease caused by a bacterial organism, the contagion of which is disseminated through the atmosphere, and, when inspired with the air, infects the animal. That the contagion of hog cholera is thus disseminated, appears to be accepted by all who have studied it. We may doubt its dissemination in this way for a mile, or even a half mile, as is asserted by some, but it seems unquestionable, at present, that it does spread for a certain distance, not accurately defined, through the air.

The isolation of the micro-organism which produces this disease, and the demonstration of its pathogenic action, have certainly been a most difficult task. For at least seven years this study has been constantly going on in Europe and America. The most competent men in this line of

work have given their attention to it. Every method that the latest developments of science have suggested has been applied to the problem; and yet, when the impartial reader approaches this subject, and attempts to reach a conclusion from the literature attainable, his first decision will undoubtedly be that bacteriology is anything but an exact science. Probably the virus of no disease has been described under more different forms; nor has it ever been my fortune to find, in connection with any other subject, so much of apparently scientific and convincing evidence which leads to so many different conclusions.

Dr. Klein was first in the field, and, as long ago as 1876, described a micrococcus as present in the tissues in this malady, though he left the reader to be his own judge as to whether it had or had not any pathogenic effect. In 1878 he made an elaborate series of investigations, including culture experiments and inoculations, by which he seemed to demonstrate conclusively that the virus was a bacillus, which developed into long leptothrix filaments, and formed spores. A large number of inoculations were made, which were, according to the report, almost invariably successful. The only point which raised a suspicion as to the conclusion was the fact that most of the experimental animals showed few symptoms of disease during life, and, when slaughtered for examination, the principal lesion was an enlargement of the glands. In his most recent writings Dr. Klein attributes the cause of the plague to an entirely different bacillus, which occurs in short rods, either single, or in chains of two or three. This bacillus does not form leptothrix filaments. Its usual length is two or three micromillimetres, but in old cultures it attains a length of five micromillimetres. It produces much more decided effects when pigs are inoculated with it, and it kills mice and rabbits, but does not affect pigeons.

In 1880 the writer found a micrococcus in the blood, exudation liquids, and tissues of animals that were examined in a number of distinct and widely separated outbreaks. It was cultivated in liquids apparently uncontaminated with other germs, and when inoculated produced very severe symptoms of disease; and these symptoms, with the lesions found in slaughtered animals, were such as to lead to the conclusion that the induced disease was identical with that which occurs spontaneously. These experiments have since been repeated a number of times in almost every year since that time, with substantially the same results. And until very recently I have believed that the essential virus of hog cholera, or, as we now call it, swine plague, was a micrococcus, and that the only contagious disease of hogs which in this country spreads to any considerable extent was produced by this particular microbion. This germ very soon lost its virulence under cultivation, and a longer series of investigations showed that its effects when inoculated were extremely variable.

It was found that many affected hogs, though slaughtered and immediately examined, contained in their exudation liquids and tissues a considerable number of distinct microbia. Among these were the bacillus of malignant œdema, or the septic vibrio of Pasteur, a chromogenous

bacillus which in cultures produced a beautiful green pigment, bacterium termo, and several species of micrococci which, under the microscope, appeared alike, but which grew very differently in gelatine cultures. These facts made it very evident that many of the advanced cases of swine plague were complicated with septic infection ; and we can readily understand how this can occur when we examine the extensive ulceration of the intestines which occurs in this malady.

To separate the different organisms found in the bodies of sick hogs, and to determine which was the pathogenic germ of swine plague and which were septic complications or epi-phenomena, has been a work of great magnitude, which has occupied our time at the laboratory of the Bureau of Animal Industry ever since that laboratory was established, in 1883. By a long series of unfortunate mishaps we secured animals for examination and experiment which had probably passed the first stages of the disease, and in which the septic germs and septic phenomena had assumed undue prominence. But we at last obtained animals from an affected herd near the city which were in the first stages of the malady, and from which have been produced as acute and virulent cases as any which have been described by those who have investigated the matter in this country.

The pathogenic germ found in this series of subjects is rather a bacterium than a bacillus, though we have not yet had time to work up its life history. It is motile in liquid cultures, and in that condition under the microscope resembles very closely bacterium termo. Mice inoculated with it contract disease after a period of incubation varying from three to ten days, and die five to sixteen days after inoculation. Rabbits and pigeons are also affected, and die when inoculated with it. Two pigs inoculated with cultivated organisms contracted the plague, and died within a week. The microbion was found in great abundance in the organs of the dead animals.

This microbion is certainly a very virulent one. It was found in acute spontaneous cases, and in inoculated animals it produces the symptoms and lesions of swine plague. It remains for us to determine whether the outbreaks of other states are caused by it ; for, with our experience with septic organisms in the past, it will require the most overwhelming evidence to satisfy us in the future.

In 1883 M. Pasteur presented a communication to the Paris Academy of Science, in which he stated that the *rouget* of France, believed to be identical with our swine plague, was caused by a figure of eight or dumb-bell shaped microbion. This germ killed pigeons and rabbits, and might be so attenuated by passing it through the bodies of rabbits that it became a vaccine when reinoculated on hogs. This communication was based upon the investigations of his assistant, M. Thuillier. Since then M. Pasteur has been supplying a vaccine for *rouget*, and scientific men have been not a little surprised to find that the active principle of this vaccine was not a figure of eight organism, but a fine baccillus which grows in cultures into filaments of considerable length. The organism discovered

by Thuillier seems to have been discarded in favor of this, but no word from Pasteur has explained the reason for the substitution.

In Germany the disease known as *rothlauf*, which is believed to be identical with *rouget*, has been studied by Dr. Loeffler, of the Imperial Health Office, and he has found in it a fine baccillus, apparently identical with that in Pasteur's vaccine. It is to be noted, however, that the period of incubation of *rothlauf* is much shorter than with our swine plague, being but from twenty-four hours to three days, as against five to fifteen days with our disease. There appears to be, also, a complete absence of that ulceration of the large intestines, which, with our swine plague, is the most prominent and characteristic lesion.

Another German investigator, Dr. Schottelius, recently states that in all spontaneous cases of *rothlauf* he finds, in connection with the fine bacillus, a different and broader one.

We have made a few investigations with Pasteur's vaccine, and we find the results with it quite unreliable in the condition in which it reaches this country. Four hogs were inoculated with the first vaccine—three with five drops each, and one with about a drachm. One of those that had five drops died: none of the others showed any reaction whatever. Twelve days after the first vaccination the three remaining animals received two and a half drops each of second vaccine, and a fourth animal, not before vaccinated, received a drachm. None of these showed any effects. A pig with American swine plague was now placed for a few hours in the same pen with these vaccinated animals, and as a result three of them contracted the disease from it and died.

We do not consider it possible that the American swine plague is caused by this fine bacillus which appears to be found in the *rouget* of France and the *rothlauf* of Germany. According to the German investigators, that germ always exists in the spleen, and is easily found. We had no difficulty in demonstrating its presence in the animal that died from inoculation with Pasteur's vaccine, but we have searched long and anxiously, though in vain, for it in the organs of animals that have died from our swine plague.

These are the facts as they appear from the investigations made up to this time. We are unable to say whether the microbion discovered by Thuillier, and that recently described by Klein, are identical with the one we are now working with; but we feel certain that the disease caused by the fine bacillus is different from any which we have studied in this country. We conclude, therefore, that to introduce Pasteur's method of vaccination for *rouget* as a preventive for our swine plague, as is advocated by some, would be a great and costly mistake, since it could not protect against the disease to which American hogs are subject, but would introduce a different and hitherto unknown plague among our swine, and thus increase the loss instead of diminishing it.

XI.

THE PROPER DISPOSAL OF THE DEAD.

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The subject of the disposal of the dead is one that has during the past few years attracted a great deal of attention, and been very thoroughly discussed. Many of the evils incident to the present plan of inhumation are set forth in the excellent paper presented to the association last year by the Rev. Mr. Beugless, and since that time there has been a further presentment of these evils by other writers, not only in this country, but abroad. The effect of this agitation has been to excite the fears and arouse the interest not only of persons of education, but the people at large. No doubt the general acceptance of the germ theory, and the surprising discoveries of Darwin and Pasteur concerning the life and office of ground-worms, have materially influenced public thought in this matter. Even those who do not favor cremation as the proper manner of disposing of the dead, admit the necessity of reform in the present mode of burial.

Cremation appears to be gaining ground in nearly all the states of the continent of Europe. A bill has been introduced in the French Chamber of Deputies by the liberal members to legalize the process, and will, no doubt, be passed without difficulty. It is supported by such advanced thinkers as Paul Bert and Tony Revillon. There are 4,380 bodies dissected in the colleges of Paris yearly. The *débris* of these bodies is now, by a special order, incinerated in an apparatus established in the cemetery of Père Lachaise. This is a great advance in the cause of sanitation and decency, as well as of religion, for Christian burial is now secured to these unfortunates. It is proposed to build a large crematorium near Paris, and an engineer has been sent to Italy to study the best plans. The method of Gorini is believed to be the most worthy of approval. Three hundred and ninety-six bodies were cremated in Italy during the past year. A very valuable contribution to the subject of inhumation has been made recently in France by Drs. du Mesnil and Fauvel, the latter a chemist attached to the municipal laboratory of Paris. These gentlemen made experiments to test the presence of carbonic acid in soils containing decomposing animal matter, notably of cemeteries. These experiments confirm those made by Schutzenberger in 1879. The circumstance that led to the experiments of Drs. du Mesnil and Fauvel

was a serious accident that occurred in the cemetery of Mount Parnasse, on the 21st of August, 1883. On that day le sieur P. and three workmen, who descended into a vault which had not been previously ventilated, were at once stricken down; le sieur P. perished, but the others after a time were resuscitated. The deductions drawn by Drs. du Mesnil and Fauvel are as follows:

"1. That in every cavity dug in the soil where organic matters are decomposing, whatever may be their origin,—sewers, cemeteries, refuse of factories, etc.,—there are produced two phenomena which jeopardize the lives of those exposed to their influence: great and very rapid disengagement of carbonic acid, and notable diminution of oxygen in the air.

"2. That the greater or less production of carbonic acid appears to depend upon the temperature of the external air.

"3. That these modifications of the constituents of the air, diminution of oxygen and increase of carbonic acid, are limited to the places excavated, and can have no influence upon the health of the inhabitants of the neighborhood."

A bill has been introduced into the Spanish Cortes allowing cremation. It is to be done when the individual desires it, not otherwise. Before cremation a certificate must be obtained; and if there be suspicious circumstances in the case, burial will not be permitted. Places must be provided under the law where the ashes of the dead will be kept free from the danger of profanation. The dreadful scenes in Grenada during the late epidemic of cholera, where hundreds of bodies remained for days uncoffined and unburied, have, no doubt, excited the Cortes to a sense of the necessity of the proposed legislation.

Cremation is also advancing in Germany. The corporation of Hamburg unanimously passed an ordinance permitting it, and the Berlin *Verein Für Innern medicin* has declared that the latest studies of well known authorities in Germany and abroad in the field of hygiene have clearly proved that cremation is the safest preventive against the spread of contagious diseases by corpses. The number of cremations in Germany during the past year was 186.

In Denmark the subject is exciting a marked interest. At the meeting of the International Congress of Medical Sciences, held at Copenhagen in 1884, Dr. Levison presented a report on the cemeteries of Denmark, and their influence on public health. This is an able and most interesting paper. After a thorough and scientific investigation, based upon personal observation, and upon official information received from local boards of health, municipal authorities, the clergy, and practitioners of medicine throughout the whole kingdom, Dr. Levison concludes that the bad effect of cemeteries upon the public health in Copenhagen has been repeatedly demonstrated. On many occasions, he says, the origin of pestilential diseases has been traced to the use of water from streams or wells which have been contaminated by the presence of cadaveric decomposition.

The water of wells in the environs is so saturated with products of

decay, that its use for drinking and household purposes is strictly forbidden. As many as four thousand to five thousand bacteria were found under microscopical examination to exist in every cubic centimetre of water, besides ammonia, nitrates, sulphuretted and carburetted hydrogen, etc. Dr. Levison traces out several epidemics of cholera and typhoid fever to the presence of cemeteries near streams supplying water to the people.

Out of 68 towns in the kingdom of Denmark, in which exact data could be obtained, 10 were demonstrated to have suffered repeatedly from infectious diseases arising from and aggravated by the environing cemeteries. Those in villages and rural districts are in even worse sanitary condition than many situated in large cities. They are generally built in the centre of the place, on a hill or elevation, from which the elements of decomposition are easily infiltrated in the soil, and in the water of springs and wells in the environs; and in these villages the only water used for the household, for horses and cattle, and for the cleaning of house and farm utensils, is well water.

In the country districts 78 epidemics, mostly of typhoid fever, were caused by cemeteries. Several schools and presbyteries, situated in the immediate vicinity of grave-yards, had to be abandoned on account of the prevalence for many years of typhoid fever in those establishments.

Dr. Levison's report is startling in many of its details, and is well worthy of the attention of sanitarians.

A meeting was held at the Parkes's Museum, London, on April 23, 1885, which was presided over by Sir Lyon Playfair. An eloquent address was delivered by Sir Spencer Wells, which was listened to by a crowded and distinguished audience. Sir Lyon Playfair made an address on taking the chair. Death, he said, was one of the conditions of life; death in the end always produced life in another form. Victor Hugo had called the carnivora the sextons of nature; and the Parsees had long acted on the grim idea by exposing their dead in the "Towers of Silence," to be devoured by vultures.

In a less direct way the dissolution of the body, whether by burial or by cremation, tended to the same perpetuation of life by death, the body being dissolved into carbonic acid, ammonia, and water, utilized by plants for their growth. Whether the change was brought about in an hour or three years, under the best conditions of burial, or in twenty years, if these conditions were less favorable, the results were identical. Sir Spencer Wells discussed the subject from every standpoint, and combated all the objections urged against cremation, sentimental, legal, medico-legal, or religious. He quoted the opinions of the Bishop of Manchester, Canon Liddon, and Lord Shaftsbury, setting at rest the theological aspect of the question. These three gentlemen belong to different schools of thought, and it may therefore be inferred that any prejudice which exists on this subject will soon give way to a fuller knowledge of its religious phases. Those who object on sentimental grounds can know very little of the working of many suburban cemeteries, where

bodies are heaped in layers in a clay soil; neither can they have tried, even for a moment, to realize what is going on in many country church-yards, where overcrowding is unfortunately too prevalent. Sir Spencer Wells quoted the report recently made by Dr. Quirk, medical officer of health of Pelltown district. Dr. Quirk reported that in the grave-yard in the village of Coning the soil was water-logged, and that he had found men engaged in excavating a new grave by digging through coffins and the putrid remains of persons previously interred. A very effective contrast to such facts, and to our habit of burying the honored dead under the floors of cathedrals and churches, was, of course, easily drawn by describing the recent discovery of the ashes of an emperor of Rome, intact and unaltered, just as they had been deposited in the cinerary urn by sorrowing relatives. The discussions which followed on the subject were of the most interesting character. Dr. Poore and Mr. Seymour Haden submitted their plans for what they termed proper burial. Dr. Poore's scheme is to make cemeteries and church-yards beautiful places of recreation. He estimates that fifty acres a year would be required to bury the dead of London, one in each grave. A grave should never be sold in perpetuity, but only for a term of years; at the end of that time the ground should revert to the community. In this way the cemetery would in time become public property, and could be converted into a public garden without any outlay of purchase-money. Mr. Haden contends that burial properly conducted is a perfectly harmless process. He admits that our cemeteries, conducted as they are, are centres of pestilence, but holds that when the body is properly buried, so that it can come in contact with the earth, it harmlessly decays, and disappears in three, or at most, five years. Mr. Haden's plan is to place the body in a wicker basket, or immediately on the earth, enshrouding it in the lightest covering possible, so that the soil may rapidly exercise its oxidizing effects. It is strange that Mr. Seymour Haden should suggest the very same means for the prompt dissolution of the body employed so violently in the last century by the Grand Duke of Tuscany. There is now practically no discussion in England as to the legality of cremation. When the cremation society first started, it was advised by the highest legal authority, including Dr. Tristran and the lord chancellor, that if cremation were practical, without causing a nuisance or exciting a breach of the peace, it was not illegal. Sir James Stephen has charged since that time that it is a legal process, and four persons have been this year cremated in England. The *British Medical Journal* says that there is some hope that the city of London may erect a crematorium at Ilford, where 9,000 bodies are interred every year. The enormous size and the continual rapid extension of London render the evils of the present system of burial very prominent; and there can be no question that the general adoption of cremation for rich and poor would supply an immediate and permanent solution of a difficulty which is already serious, and threatens to assume still more alarming proportions.

A society called the Church of England Funeral Reform Association

has been organized in London for the purpose of reforming the abuses that have grown up in the mode of burying the dead in the earth. The secretary, in a published letter, states that the association is quite alive to the evils which have created a desire for cremation,—evasive burials in solid coffins; bodies buried so thick in the earth as to saturate it with the products of decomposition; and grave-yards made breeding-places of disease. The remedy proposed, the secretary further states, is that of slow cremation, which Liebig calls "Cremacausis," disintegration of the body by the natural action upon it of the earth and air, burying it in a rapidly perishable coffin, in the simple earth, in accordance with the church's order. This is simply the plan suggested by Mr. Haden. The agitation of this question has led to the formation of a cemetery company known as the "London Necropolis Corporation." This company has purchased two thousand acres of dry, gravelly soil at Woking Common. Woking is near Burkwood, Surrey, about ten miles out of London by the South-Western Railway. The coffin used in interments at Woking is made of pulp, or *papier-maché*, which, while to all appearance as solid and enduring as the ordinary coffin, speedily dissolves when put in the ground and placed in contact with the earth.

Other schemes for the disposition of the dead have been urged with more or less ingenuity. Mr. Pratt, of London, proposes to bury dead paupers in cheap coffins, which are to be cemented with concrete, and used in building a breakwater at Herne bay. This scheme, we are happy to say, has not met with much favor. A more artistic but equally repulsive method is suggested by M. Kergovatz, a chemist of Brest. He proposes taking a corpse and rubbing it with a chemical solution, and then plunging it into a metallic bath, so as to invest it with an air-tight covering of metal. Any kind of metal may be employed,—gold, silver, copper, or zinc,—according to the wealth or taste of those interested. By this plan the dead could be utilized as statuary, and a rich man could fill up his art galleries with his dead relatives. The Roman nobles, who, according to Ammianus Marcellinus, with the vain intention of perpetuating their memory, erected likenesses of themselves made of brass or bronze, covered with plates of gold, might have effected their purpose better by the plan thus suggested by this chemist of Brest.

Burial reform has, however, made great progress in other respects during the past year in England. The old devices in use, such as palls, feathers, hat-bands, scarfs, etc., are being discarded at funerals, and less expensive means adopted. The highest dignitaries of the church, including the Archbishop of York, have taken up the matter in an earnest manner, and we may look for still further reforms in the future. It is now contended on all sides that the old triple coffin should be discarded, and one made from the most perishable materials take its place. The hand-bier, it is said, should be employed instead of the insanitary habit of carrying the body on the shoulders. Parliament has passed an act forbidding building on any disused burial-ground. The London Local Government Board declares officially, to the end that cemeteries shall not

breed disease, it is absolutely necessary that the number of decomposing bodies in a given portion of ground shall not at any time be so great that the gaseous product cannot be oxidized into harmless substances in the interstices of the soil, or taken up by vegetation, with a sufficient depth of earth intervening between the corpses and the surface, and with the soil of a suitable nature and properly drained, the drainage water being innoculously disposed of. The danger of old burial-grounds to the public health is now generally recognized, and precautions are being suggested to avert the perils incident to their existence in communities. It is suggested that the earth should be saturated with agents destructive of the underlying corrupt material, and that the site, after a time, should be planted with vegetation adapted to exhaust the soil. It is admitted on all sides that the land cannot be left undisturbed with safety.

These suggestions show that the question of burial has become a matter of vital interest to a large body of intelligent men in Great Britain. The wisdom of all these measures cannot be questioned, and similar laws should be enacted by every enlightened community.

In our own country very little interest has been shown in the matter of burial, and no reforms have been suggested. During the year six cremation societies, however, have been organized, and two crematoria been established. There have been twenty-nine bodies cremated in Lancaster, Penn., since the erection of the crematory in that place. In this number were several well known physicians. No doubt the example of such a distinguished and enlightened man as Dr. Gross has exercised a marked influence upon the public mind, an influence which will widen with the progress of time.

Cremation is fast obtaining a *locus standi*, and no matter what may come, it will be adjudged a needful, a philosophical, and a practical idea. Its necessity in times of great epidemics is now very generally conceded. The dreadful scenes in Spain during the past summer, already referred to, will surely have an effect in procuring proper legislation in other countries. It may not be known to the general reader that a spectacle equally horrible as that witnessed at Grenada was presented at New Orleans during the epidemic of cholera in the year 1832. Dr. Davidson, an eye-witness, has recently furnished a graphic picture of the events of that time in a letter to Dr. Watkins, Sanitary Director of the Auxiliary Sanitary Association of New Orleans. This sketch was published in *The Sanitarian* of September, 1885. Dr. Davidson says,—

"The ravages of the epidemic augmented fearfully day by day; and so great was the mortality, and so inadequate the facilities for the care of the dead, that corpses remained in the houses for indefinite periods of time. No attempt at regular intervals was possible. Men were employed by the authorities to cart away the dead; the bodies were heaped promiscuously in the carts; and the drivers, with a bag of camphor to their noses, rapidly conveyed their human burdens to the cemetery, dumping the loads just within its gate." And again: "The unshrouded dead dumped at the gateway of the Girod-street cemetery accumulated

in such numbers that the entrance to its precincts was so obstructed that arriving bodies had to be deposited on the outside. No graves at this time could be dug. No coffins were procurable, for there were neither grave-diggers to be had nor undertakers to be found. The city council were forced to order out the chain-gang, prisoners from the city jails, to dig a trench the whole length of the lower side of the cemetery. It was dug some twelve or fifteen feet wide, and as deep as the water-logged soil would permit. Into this receptacle the decomposing bodies were dragged by hooks from the fire companies, without the formality of precedence or order of any kind. As a part of the trench was filled, the earth was heaped upon the remains of the rich and the poor, the aged and the young.

"One striking incident may be related of the utter impossibility to regard the claims of the exalted to the common decencies of sepulture. The attorney-general of the state died in the lower part of the city, and laid two days without removal. A friend, the late Charles Gardiner, of this city, obtained a hack at an enormous price, to carry the remains to God's Acre. The driver and himself placed the body in the hack, conveyed it to the Girod-street cemetery, and left it on the ground, amid the heap of those who had preceded it to that common resting-spot.

"How many similar occurrences could be named! One more, and the veil must be drawn over so sad and painful a picture. The United States Marine Hospital, a portion of which still remains, was situated at the corner of Circus (now Rampart) street and Poydras canal—now the Poydras market. It was under the care of the late Dr. James S. MacFarland. He sickened with cholera, and the resident physician in charge, Dr. George W. Roe, and his assistant, both died of the epidemic. The stricken inmates, to the number of thirty or forty, bereft of all care and supervision, died also, and their bodies, after several days, became so decomposed that the city council passed an ordinance to have the hospital burned, with the dead it contained; but the inhabitants residing in the immediate vicinity, fearing that the conflagration might extend to their dwellings, and no fire companies being available to protect them, petitioned the mayor not to carry the ordinance into execution, they engaging to remove the bodies into the centre of a vacant square, upon a part of which the hospital stood, and there to burn them. This was granted, and the dead were drawn forth by hooks from the fire companies, and a funeral pyre was made of the fencing around the square, and the bodies incinerated. At Norfolk, during the epidemic of yellow fever in 1855, twenty-one bodies lay in a heap in the hospital yard for days, exposed to a September sun, owing to the want of coffins or other means of burial. They were finally interred in shallow trenches."

Scenes like these are a reproach to our civilization, and it is to be hoped they will never again be witnessed on this continent. The discovery, a few months since, in the Chinese quarters of San Francisco, of a large number of bodies in preparation, by boiling, for transportation to China, caused a shudder throughout the whole land, but this process has at least the merit of rendering the dead innocuous to the living.

At the last meeting of the association at St. Louis, the statement was made by a member, who is the author of a text-book of sanitary science, that no trustworthy evidence can be adduced to show that any infectious disease has ever been communicated from cemeteries after bodies have begun to decompose. This opinion naturally created some surprise. In addition to the great mass of testimony on this subject in the past, the literature of the present year furnishes important additional facts. Leaving out the startling statements of Dr. Levison concerning the kingdom of Denmark, already referred to, as well as the assertion of Dr. Freire, of Rio Janeiro, that the cemeteries of that city are the nurseries of yellow fever, we find in the New Jersey State Board of Health Report for the year 1884 the following account of the cemeteries of that state: "In the last report of this board, an able and careful paper on 'Interments' presented the reasons why the custom of interments within city limits should cease, and why, also, in townships and near villages, the habit of allowing companies to locate cemeteries without any regard to the approval of the health boards could be no longer tolerated. Various facts as to graveyards and cemeteries in different parts of the state make it certain that water is often polluted from such causes, and that the air is fouled by exhalations from overcrowded burial-grounds. Often spots are chosen without any reference to the relations of dwellings, and without proper regard to soil or under-drainage. Since the paper was written, the developments made by the township committee of North Bergen township, in Hudson county, have given great emphasis thereto. They have shown that the five cemeteries of the township have polluted both the air and the water, and that the irresponsible manner of conducting burials, as well as the localities of these cemeteries, has made them a menace to the health of adjacent cities, and to the immediate township concerned. Burial has become a commercial industry, so that commercial travellers solicit patronage, and secure profits that are large. Success is based upon having the cemeteries of very easy access to cities, and upon the placing of many coffins in the same grave, or in the same small plot. On the Weehawken side and palisades of the joint cemetery, twenty-eight graves were examined. In five the top of the box was from eleven to twenty-two inches below the surface; eleven from twenty-five to thirty-eight inches; and nearly all the others less than four feet. Hoboken cemetery, in about twenty-two graves examined, had seven less than three feet, and the most of the rest less than four feet. In the pauper part "they bury four bodies in one grave." Grove cemetery, in seventeen examinations, had none as deep as five feet, and most less than four feet. In the burying-ground on Snake hill, in about thirty-two measurements, the depth from the surface of the ground to the top of the box was three and one half inches, or less in four cases; from four to eleven inches in ten cases; from twelve to twenty inches in eleven cases; and but one in the whole number more than twenty-six inches. Much of this probably arises from the plan of putting more than one body in a grave. While these are no doubt not specimens of what universally prevails in cemeteries, it is true

that there is need of some more accurate legislation as to cemeteries and burial-grounds, so that they shall not endanger the public health."

The medical journals of the year also contain reports of outbreaks of typhoid fever, due to the use of drinking-water polluted by the drainage from grave-yards. The following analysis of the water from a well immediately outside of the wall of Green Mount cemetery, in Baltimore, made by Professor Tonry, last summer, will afford some idea of the influence of cemeteries on the adjacent soil:

Free ammonia (per litre) milligramme . . .	00.02
Albuminoid	00.14
Chlorine, grains per gallon	4.40
Volatile solids, grains per gallon	14.00
Mineral solids	10.00
Total solids	24.00

This cemetery is within the city limits, and dwellings are being erected on all sides of it.

Some very curious experiments have been made to show the oxidizing action of the soil upon nitrogenous matter. These experiments show that oxidation in the soil does not depend entirely upon chemical reaction, but is due to the presence of small living organisms. These organisms are believed to be micrococci somewhat resembling the yeast plant. Many and varied tests have been made to determine the conditions under which the disinfecting microbe lives and acts, and a great deal has been learned about its habits. It is found that it flourishes best and is most efficient at a temperature of about 98° F.—nearly the temperature of the blood. At higher or lower temperatures its action becomes more feeble, and ceases altogether near the freezing point, or above 130°. Experiments to show its distribution in a clay soil prove that it is most abundant in the upper six inches, but is found to a depth of a foot and a half. Below that depth it cannot live, and soil taken more than eighteen inches below the surface has hitherto always failed to induce any change in nitrogenous solutions to which it was applied. Should further experiments confirm this theory, it must exercise a marked influence on the question of earth burial.

If the present mode of burial is continued, as it will be, no doubt, for many years to come, great and radical reforms must be instituted to protect the living from the contamination of the dead. Interments must be regulated by legislation, and placed under the control of the health authorities. Not only the time but all the details of burial must be fixed by ordinance. That obstructive and frequently ghastly process, embalming, which is but a feeble imitation of the mummification of the past, should be absolutely prohibited. Dissolution of the body must be hastened, not retarded. The circumstances connected with the death and interment of our late lamented vice-president are a sad commentary on our modern civilization. The omission of a necropsy to ascertain the true cause of death, the embalming of the body, the imperishable cedar

casket, the marble vault elevated above the surrounding earth,—this is the painful story that is nearly every day repeated in the land. "These be thy gods, O Israel!"

The sites of cemeteries should also be regulated by law. The nature of the soil, the drainage, the nearness of dwellings, etc., ought all to be matters of consideration. For sanitary reasons, and for the purpose of saving expense, cemeteries should be placed ten or twelve miles from cities, on lines of railroad. This plan, which would lessen the labor and fatigue in attending funerals, is now in contemplation in Paris. A special railroad to the cemetery De Mery-Sur-Oise, leaving Cimetiere Du Nord, and running through Gennevilliers, Argenteuil, Sannois, Cormeilles, and Herblay-Montigny, has been surveyed by direction of the municipal council. Seven hundred and twenty-eight acres of land have been purchased for this proposed city of the dead.

Not more than one body should be allowed in a grave, and chemical means should be employed to hasten dissolution. The care of the dead, even before burial, should be under the supervision of the health authorities. They should have the power to regulate the arrangement for the funerals of all persons dying from contagious diseases. In such cases no one should be allowed to visit the dead—not even relatives. The use of public carriages should be prohibited. These measures may seem arbitrary; but if the state has the power, as it undoubtedly has, to legislate in regard to the living body, it has the still greater right to provide for the disposal of the dead body, so that it may not prove a source of evil to the living. It is not only the right but the duty of the state to institute all necessary rules to protect society in this regard.

If incineration were accepted, all these evils would be averted. It is generally admitted at this time, that this process should be adopted in all great epidemics and after battles; but it would be a wise measure to extend it to cases of zymotic disease, such as cholera, small-pox, scarlet fever, and diphtheria. These poisons are preserved for years, and at certain times, under certain conditions, vent their destructive force on the human race.

The objections to cremation are very inconsequential. It is said that it is a pagan rite; but the custom of wearing mourning, now in such general use, is also of pagan origin, and for that reason was entirely discarded by the early Christians. There is not a line in Holy Writ condemning it. Its expensiveness has been urged by the London *Lancet*, but this objection is not a valid one. At Milan the cost of cremating a body is seven or eight francs. At Paris it will be fifteen francs, or three dollars, including fuel, labor, and the cinerary urn of common pottery. The only objection to cremation which has any real force is, that the practice might destroy evidences of crime. This is a superficial view of the matter, for if cremation were established, greater precautions would be taken to ascertain the true causes of death. At present, if a person dies suddenly, or is found dead in bed, no post-mortem is held or legal inquiry instituted. A medical man signs a certificate of death from par-

alysis of the heart, apoplexy, or some other supposed trouble. Consequently our vital statistics are worthless, and afford no facts on which to base deductions in regard to the mortality of the country. If cremation were the custom, a much more rigid course of inquiry would be adopted. Necropsies would be the rule, instead of the exception, as at present. The system of verification now in force in some parts of Europe would come into use. This plan requires an examination of the body by two physicians before burial, and affords ample protection to society. Deaths from the effects of minerals and mineral acids are easily ascertained by a proper examination, and the proofs can always be discovered in the ashes, if necessary. The detection of the poisonous alkaloids would be more difficult, but more stringent laws could be enacted and enforced to prevent their sale. The symptoms of poisoning by opium, strychnia, and aconite are so striking and so well known, that they could not be readily overlooked by two medical men. The custom of embalming a dead body by intra-venous injections of mineral solutions, now so generally in vogue, destroys all evidence of poisoning, yet no one objects to it on precautionary grounds.

The future has many blessings in store for us. The prejudices of education are fast being dissipated as this matter is discussed and more thoroughly understood; indeed, a large number of advocates of cremation have been attracted to it by the charm of sentiment alone. This will grow year by year, until a general acquiescence will finally be obtained among all men. This result may not be brought about in our day, but it will surely be witnessed by those who are to follow us.

In the meantime legislation on the subject is timely and needful. It should be procured in every state in the Union, so as to provide for any emergency that may arise. Massachusetts has already passed an act legalizing incineration. The health authorities of New York have the question of its legality under consideration, and forty bodies are ready to be cremated as soon as permits are granted. The letter of the New York law calls for *burial.* This the cremationists, however, are endeavoring to overcome by the argument of negation, there being no law *against it*—a dangerous doctrine, certainly, whatever may be our opinion of cremation in the abstract.

We are, however, working in the interest of all men. Our labor is a consecration, but not a dream. We are not legislating for this generation, for the evils of the present mode of disposing of the dead are not yet so alarming as to arouse great fear. It is for the good of those who are to live after us, who must necessarily suffer unless a reform is instituted, that we are laboring. As men become better acquainted with sanitary principles, this truth will become more apparent. The school-boy of the future will know more of sanitary science than the oldest and wisest men of our time. We, however, have the proud consciousness of knowing that in our own day, and by the efforts of our own contemporaries, the initial steps have been taken for the sanitary improvement of the world, and the betterment of the race.

XII.

THE SANITARY PROTECTION OF NEW ORLEANS, MUNICIPAL AND MARITIME.

By JOSEPH HOLT, M. D., President of the Board of Health of the State of Louisiana.

In order to avoid the error of prolixity,—that unpardonable sin against intelligence, and imposition upon amiable endurance,—I shall present the subject of this paper in the form of generalizations, in the exposition of principles underlying action, rather than the narration of plans and specifications of municipal drainage and sewerage, of buildings, machinery, and general paraphernalia of quarantine stations, in weary detail.

Furthermore, to particularize and to dwell upon our achievements longer than to state that the health authorities of Louisiana, acting in perfect accord with advanced sanitarians of our country, sustained and encouraged by the moral weight of their consent, have enforced in practice the established doctrines of sanitary science, would savor of boastful pretension foreign to the purpose of this paper, and contrary to the spirit of the Louisiana State Board of Health.

With feelings of humble gratitude, not of pride, we declare our earnest belief, that, guided by the light of preventive medicine, of this star newly risen in the firmament of our destiny, in the adopted methods of "*maritime sanitation*," we have given to the people of New Orleans a new hope,—to the people of the Mississippi valley the highest known guaranty against the introduction of pestilence, while at the same time we have removed from commerce a bar heretofore insuperable.

The systematic sanitation of New Orleans is grand, almost limitless *in possibilities*, in realization *prospective*, a great achievement *in the future*. Its status is identical with that of faith—" the substance of things hoped for, the evidence of things not seen." On account of geographical position, its nearness to the tropics, and location on the edge of the Gulf of Mexico (a vast body of warm water), together with its situation on a low swamp soil or alluvium, New Orleans, of all cities in the United States, requires a thorough system of drainage and sewerage, as the foundation of health and comfort, upon which her hope of prosperity depends. The exactions of sanitary law, imposed by a combination of physical conditions,—high temperature, excessive humidity, lack of natural drainage,

low situation, almost on a sea-level,—are peremptory and severe. Disobedience, whether the excuse be ignorance, poverty, or negligence, is more certain of rebuke than a like transgression on the part of communities in higher latitudes.

We are an unfortunate demonstration that justice, in the realm of Nature, is indeed blind, and her scales out of balance; that even Nature is partial in the execution of judgment for violated law. Those negligences which she allows as mere venalities in Washington, New York, Baltimore, or St. Louis, become most heinous and outrageous violations in the case of New Orleans.

To illustrate this, let us for a moment suppose Chicago and New Orleans, moved by some gigantic force, suddenly to exchange places, the sanitary condition of each remaining the same: upon the approach of the so-called danger period of next summer, which city, do you imagine, would look forward to the time with anxious foreboding, tinged with terror, and which with a smile of complacency?

This explanation of the relation of New Orleans to sanitary law is not offered as an apology for existing conditions. On the contrary, it stands in judgment against us; for, however just or unjust, Nature is unmoved by sentiment, nor can the course of natural law be altered by apology. Of us is much required, and there is no extenuation nor appeal. Her demands are imperative, and must be satisfied.

Let none of my remarks be interpreted as disrespectful to Nature, or as taking her to task for the unequal distribution of the consequences of violated law. Being a citizen of New Orleans, gentlemen, I am afraid of Nature. She is a loving mother to you, but a step-mother to us. Generous to a fault, she lavishes upon us in wasteful profusion her precious favors. She gives us in abundance the best of food; canopies us under skies of softest tint; fans us with balmy breezes; and decorates herself in perfumed robes of loveliest flowers, in the ample folds of which she carries, concealed, a rod, ready with a will to lay it on.

With natural advantages of a kind such as, with care on our part, would soon make New Orleans a desirable place of abode, second to no maritime city in the world, we have the highest double incentive to effort,—the richest reward for intelligent, persevering, laborious obedience on the one hand, and certainty of punishment for inaction on the other.

But let us placate Nature by singing her praises, if she is not equally insensible to praise and anathema. She is kind, she is indulgent and considerate! Seeing how little we have done to help ourselves, it is a matter for congratulation and of astonishment that consequences have not been more severe.

However ready in the inflictions of chastisement, Nature is constantly working in our behalf. We have neglected to provide adequately for the removal of sewage matter, while she continually tries to condone the fault by the destructive process of oxidation. She has generously washed our streets and back yards every day, for weeks at a time, with millions of tons of pure, fresh water, and has never yet presented a bill for her ser-

vices. Having no sufficient drainage or sewerage, we would long since have been in a woful plight but for this constant operation of natural law in providing ways and means for our preservation.

It is a glorious tribute to the philanthropic zeal of sanitarians, and a positive demonstration of the effectiveness of their labors, seconded by the mighty power of an intelligent press, that the people of New Orleans are progressing in practical knowledge appertaining to public health and comfort, at a rate exceeding the expectation of the most hopeful of ten years ago.

Under the constant attrition of teaching, this continual iteration of precept upon precept, line upon line, here a little, there a little, the whole mass of population is becoming progressively comprehensive of their necessities, more intelligently appreciative of their surroundings, of the causes of discomfort predisposing to sickness, and impressed with an earnest desire for improvement.

As a people, we are venturing upon the high road to reformation. The popular sentiment is becoming responsive to the guidance of science, and appreciative of the value of preventive medicine. The educational process is at best a slow one; even with an individual, often tedious. How much the more slowly progressive must we expect the movement along new channels of thought to be, in the acquisition of ideas projected upon higher planes of knowledge, the vast intellect of a great city!

New Orleans is moving onward and upward to achievements which shall place her, by universal consent, in the position she should rightfully occupy among her sisters, in the foremost rank of American cities. Holding the thread of her own fate, her destiny must be self-determined. At this moment she is moving to the establishment of systematic sanitation to overcome the defects which have cost her so dearly. Even now the main question of providing ways and means for the efficient drainage and sewerage of the city is being urged, with a general interest and earnestness which foreshadow substantial results.

The proposition is being discussed of creating a Board of Public Works, untrammelled by political entanglements, and not subject to the changes incident to party warfare,—a board composed of citizens chosen for their integrity, clear judgment, zeal, and efficiency, as public-spirited men. Such a body, constituted for an ample period, with associate engineers competent to give expert consideration to all phases of the problem, would soon formulate a general plan, which would be carried out step by step, with immediate amelioration of present necessities, in the direction of permanent improvement and relief, and that without creating a debt or requiring the levy of a burdensome tax.

With a comprehensive plan under such supervision, every dollar would be accounted for, and placed where it could do the greatest public good. The sanitary redemption of New Orleans, from being a dream of the future, would soon become an assured fact. An era of prosperity would open upon Louisiana with such a golden radiance as would send a thrill of unfeigned joy into the heart of every American whose national pride

and patriotic love of this glorious unity is generous, and as broad as the scope of this broad land which is his heritage.

THE SANITARY PROTECTION OF NEW ORLEANS—MARITIME.

Maritime sanitation has taken the place of quarantine on the seaboard approaches to New Orleans.

The term is in itself a complete acknowledgment and a declaration of allegiance to the germ theory of the great pestilential infections, just as the word quarantine carries within itself the essential idea of prolonged detention; a virtual acknowledgment of utter ignorance of all the conclusions established by modern observation of the phenomena of these diseases, confirmed by microscopic research and experimental tests in the announcements of Pasteur, Koch, Klien; in the voices from the far regions of the tropics, Carmona, Freire, and their able coadjutors; and last, but of the first magnitude in this blazing galaxy of lights, Sternberg!

The inevitable conclusions deduced from the observed conduct of these diseases have compelled the germ theory of their nature. It is no ingenious figure of the imagination, but a doctrine hammered into shape by sheer force of logic. Every phenomenon of measles, scarlatina, diphtheria, small-pox, cholera, and yellow fever, gives a sledge-hammer blow, driving into us the idea of a living organism, a definite entity, as the essential cause of each, differing in kind according to the disease.

Laying aside certain hypercritical sophistries and the off-hand denunciations of constitutional objectors, even against Jenner himself, we may now declare that the germ nature of these diseases has passed from the form of a diluted theory into that of a crystallized fact; so that now, in contending against the introduction of pestilence along the highways of commerce, we no longer oppose mysterious phantoms with the suggestions of superstition, but fight a real and defined enemy with substantial shot and shell, so to speak, potent to destroy.

Even in our municipal management, bonfires of tar-barrels, religious processions, and long-drawn prayers no longer count as disinfectants. These methods have swamped us invariably. Their failure has compelled us to rely upon the intellectual spirit within ourselves, and to change the personality of our enemy. We no longer fight the machinations of the devil, or the devil himself, but a microscopic germ, a living ferment, a little leaven, which, if not speedily destroyed, soon "leaveneth the whole lump."

If there is any truth in the germ theory,—and no proposition admits of clearer proof confirmed by demonstration,—then may we confidently declare that "*maritime sanitation*," as conducted in the stations of Louisiana, is worthy of reliance in offering the highest relative guaranty against importation. If the essential element or originating principle of small-pox, yellow fever, and cholera can be demonstrated to exist within a definite and circumscribed limit, as in the field of a microscope, on the point of a scalpel, within the compass of a hypodermic syringe, or the

hull of a ship, and is capable of indefinite extension beyond that limit, it is conclusive that the essential cause, or virus, having power of extension, can only do so by reproduction. It is, therefore, a living entity; and, being definable *in loco*, it can be destroyed *in loco*. This is the sum of all the law governing maritime sanitation.

The hypodermic syringe or the infected ship we may destroy with fire; the pestilential infection within will likewise be destroyed. The same line of reasoning extends to other agents than fire. If every known organic form of life can be destroyed with the bi-chloride of mercury, the concentrated fumes of sulphurous acid gas, and exposure in the superheated steam-drying chamber, the conclusion is inevitable that hypothetical organic forms can also be destroyed. Seeing the germ satisfies the intelligence and confirms belief, but is not essential to the validity of disinfection.

To strengthen every part of this position, we have accumulating assurances that these sometime hypothetical forms *are being isolated*, *cultivated*, *photographed*, in testimony of their reality. Under a pressure of inconceivable intensity, carbon, in a vague and unsubstantial form, suddenly crystallizes into a hard and sharp-cutting fact, called the diamond. So may these assurances of experimental microscopists, under the prodigious pressure of unbelieving opposition, crystallize into ascertained facts, into sharp-edged brilliants, wherewith we may yet be enabled to cut the bands which have fettered the human race under the bondage of pestilence. The experiences of Jenner may yet repeat themselves.

When the decks, cabins, forecastle, hold, bilge, and every available part of a vessel, together with all the baggage and apparel of every person on board, have been thoroughly wetted with the solution—one to one thousand—of the bi-chloride of mercury, and the entire atmosphere within displaced with the concentrated sulphurous acid gas, we have availed ourselves of the highest assurance as yet offered by science in the practicable and speedy disinfection of a ship. At present there is but one guaranty of a more positive kind—total destruction by fire. When the process has been accomplished by the use of apparatus competent to do the work, there remains but one source of danger in the subsequent outbreak of the disease, cholera or yellow fever already incubating in the system.

Here again the entire weight of testimony, established by such exact observations as furnish a scientific test, confirmed by the experiments of recent investigators, shows that the deadly ferment of these two diseases, once received into the human system, is not dilatory or uncertain in its incubatory movement, like that of small-pox, diphtheria, scarlatina, or hydrophobia, but, like the mortal virus of the cobra, is almost explosive in the rapidity of its action.

That a person should move about in the routine of his daily life, for days or weeks, with the germs of yellow fever engendering in his blood, or of cholera upon the mucous surface of the intestinal tract, and the vic-

tim unaware of his disorder, is contrary to expectation, to common-sense, and to all the teachings of carefully guarded observation and scientific research.

However common the reported cases of prolonged incubation, in every instance of clearly ascertained moment of exposure, and in the experimental tests declared to be true, the period of incubation has been remarkably short—usually within forty-eight hours, never beyond three days. Several occurrences in our quarantine experience of the past season have been singularly corroborative of this statement. To give ample margin, however, and to keep on the safe side of possibilities, if a vessel has cleared from or touched at an infected port, we detain her five days. In the case of a vessel actually infected, she is remanded to the station provided for such vessels only, where she is treated with exceptional rigor, and held for a period of seven to ten days, from the date of removal to hospital of her sick and completion of the disinfection.

Under any other system than that of sanitation of the most exacting kind, neither days nor weeks of detention can afford reasonable safety. Instances of failure can be multiplied to weariness. One of the latest will suffice: Cholera broke out in the harbor of Toulon on a ship from Saigon, in Chinese waters, where she had been exposed to cholera several months before, without cases in the interim.

Yellow fever and cholera are due to living organisms. To destroy these directly is the object of our efforts. I declare my conviction that the bi-chloride of mercury is potent to effect their instant destruction, and that it possesses every qualification as a disinfectant, above all others, to be desired.

Moving in the line of its reputation established in surgery, it is equally to be relied upon in municipal and maritime sanitation. Preëminently a germicide, colorless, stainless, odorless, not injurious to fabrics, perfectly safe to handle for months at a time, and exceedingly cheap, it is impossible to imagine a substance more efficient, and free from objection in practice. The addition of a little indigo to the solution will abundantly warn any one against drinking it—the only danger that might attend its use. Having had under observation a considerable body of men working in it daily as though it were rain-water, and ships making repeated voyages, and upon each return drenched with it without injurious effect, is the highest testimony to its safety.

Unencumbered with objections which belong to other disinfectants, through the efficiency of this agent we are enabled to transfer the war against pestilence to a higher plane of decisive action, and to wage a fight, whether on shipboard or in town, in every respect parallel with that of fighting fire.

The surest preventive of a conflagration is to quench the first spark: the surest preventive of an epidemic is to act upon the mere possibility of the existence of infection. Not proclaiming itself by such outward evidences as light and heat and smoke, but incognizable to the senses, we must wage fight upon the *suspicion* of a pestilential manifestation.

In maritime sanitation we subject to treatment every ship coming from cholera or yellow fever regions, *regardless of bills of health, however clean;* while in municipal sanitation we attack, *in loco*, the slightest signs of these diseases. To cite an instance: Small-pox declared itself in nine distinct foci during the past winter, in the most crowded parts of this city. Being treated with these agents of destruction, applied with the extremest exaction of scientific requirement, the disease did not spread beyond the room of the primary cases.

If the schedule of symptoms in a single case is such as would indicate and be diagnosed cholera or yellow fever, during an epidemic of one or the other of these diseases, we act promptly in the enforcement of isolation and precautionary measures of disinfection, as though assured of the worst. While willing to call the case "*suspicious*," we are determined to have no second case to confirm the nature of the first. Ceasing to be sticklers for an exact diagnosis, we are content to resist even the appearance of evil.

Intangible, imponderable, unrecognizable by the unaided senses, and even with the best of aid only to the trained master in microscopy, the subtle nature of the essential agent of pestilence compels, in practice, the retention of the term "*suspicious*," as applied to first cases of which we cannot be positive. The term must be retained, however much it may provoke harsh criticism and angry censure of those engaged in trade. These demand that there shall be no report until every doubt is removed, and the nature of the disease confirmed, which can only be in the repetition of cases, and hopeless consignment to an epidemic.

It would be indeed a sorrowful recital to recount the disasters wrought through the powerful influence of a hideously selfish and depraved trade interest. This narrow-minded, cold-hearted element is found in every business community, and in some is predominant. Ignorant, arrogant, utterly unscrupulous in the means to attain its ends, pretending to exceptional respectability while inciting the popular hue and cry in its behalf, it essays with malignant vehemence, upon occasion, to subordinate all authority, every principle of honor, of humanity, and of prudence, bending all honesty, all obligation, and all law to the purposes of its own will—the *will* of a class of whom it has been said, "Their ledger is their Bible, and gold their god."

Feeble-spirited and superserviceable health authorities, and even bureaus of government, timorously submitting to the dictum of this unrighteous Mammon, *have* suppressed the truth, *have* falsified reports, and *have* consigned states and nations to the ravages of unresisted pestilence, when thousands of lives might have been saved, at least by flight, and distant communities, forewarned, might have protected themselves. Witness the outrageous transactions in France, Spain, Italy, during the last few months, and the repeated occurrences in cities of our own land, in times gone by.

As custodians of a sacred trust, health authorities must be true to their allegiance, and that allegiance demands perfect candor and timely warn-

ing to the people, not only of a community, but of all communities whom it may concern. Yea, more! This principle of action should be woven as a living thread into the texture of international relations. It should exist as an essential element in the comity of nations. Health authorities must be courageous, and ever ready for any sacrifice in resisting and putting under foot the insolent power that would make of them instruments for perfidious service.

The subject of this seeming digression is so woven into the affairs of practical municipal and maritime sanitation as to necessitate its fullest recognition as an incorporated part. Burdened with annoyance and tempestuous contention if resisted, it is well baited with tempting morsels, set in snares of disgrace, if allowed. Let the world beware of a board of health with commercial alliance in a line of policy. A board of health with policy is a board without truth! The one must subordinate the other. As sanitarians and officers in the health trusts of the people, we are working in the teachings of the great Master. We cannot serve God and Mammon.

The relation of New Orleans to its sanitary protection involves the welfare not only of the city and state, but of surrounding states, and of the Mississippi valley. To express in its simplest terms the direct dependence of the city upon its health protection, let us suppose these questions propounded by you at this moment: Why is New Orleans as it is? why not more progressive? why not a manufacturing and general industrial as well as a commercial city? Why does not her commerce sweep the circle of the world at all times? and, considering her age in relation with the age and growth of other American cities, why has she not a million of inhabitants? I would promptly answer you in a compound word—*Yellow-Fever!* The visitations of small-pox and cholera have not afflicted us to retard our growth more than you yourselves have felt them.

The difference is due to one thing alone—to a something superadded to the general sum of human miseries, which you have not. The whole life of that people has been touched corruptibly with the venom of the yellow plague, oozing as an exhalation from the hovering pinion-tips of the Angel of Death—the malignancy of hell on earth potential! To pluck from those hateful wings the plague-distilling quills, above the reach of mortal hand, may yet be done by science.

Moving in paths of her selection, the energies of the people will surely accomplish the redemption of New Orleans. Under her instruction we are concentrating in our defence the whole armament of germ-destroying agents; while, under her instruction, Freire and Bourgeron in Brazil, Carmona and his distinguished pupils throughout Mexico and at Panama, all of them in the nursery and hot-bed of yellow fever, pursuing their researches in the lines indicated by Pasteur, but first by Jenner, are piling up evidence in such irresistible masses, and all with the sanction and endorsement of their respective governments, as to command the hope that our salvation is even now at the threshold.

The promises of immunity by the inoculation of the essential germ or

agent causative of yellow fever are freely offered us. Every demand of humanity and prudence compels a thorough investigation of this question. To pass judgment *ad captandum*, and ignore it without a test, would be grossly unscientific and criminally indifferent.

As the apostles of sanitation in America, as fellow-soldiers in a warfare against misery and death, I appeal to you in behalf of Louisiana and of Texas, and of all the states of the southern Atlantic, the Gulf of Mexico, and of Tennessee, to endorse with your approval, and to present as the earnest desire of this composite body, the American Public Health Association, and boards of health of the United States, the following petition:

Whereas, The question of immunity from yellow fever is so intimately connected with the social, industrial, and commercial growth of Tennessee, the Southern Atlantic, and the Gulf states of the Union, as to determine the destiny of Memphis, Charleston, Savannah, Pensacola, Mobile, New Orleans, and Galveston; and

Whereas, A large and accumulating mass of testimony that the power of protecting the unacclimated against yellow fever has been discovered and proven in the inoculation of the essential germ or cause of the disease, by methods distinctly formulated and available, these aforesaid declarations and numerous instances cited in corroboration, emanating from medical scientists at the head of the biological departments in the highest institutions of learning in Mexico and Brazil, authorized by and bearing the endorsement of their respective governments;

Resolved, That we, the representatives of the boards of health in the several states of this Union, and we, the officers and members of the American Public Health Association, regarding the question as preëminently a vital issue, as one, in its assumptions, true or false, and if true, of incalculable worth, surpassing the computation of many millions of dollars, and to the saving of tens of thousands of the lives of our own people, hereby petition and urge upon both branches of congress, now assembled, the appointment by the President of a commission for the purpose of making a complete investigation, and reporting, after a thorough examination of the methods pursued, their effectiveness in protecting the unacclimated against the yellow fever infection, together with all associated observations and experiments that may be ascertained.

Resolved, That in the aforesaid petition the commission shall be stated to consist of three persons, one of whom shall be of known ability and special attainment in biological research, particularly in the department of microscopic investigation and culture of the essential germ causative of the infectious and contagious diseases. The other two members of the commission shall be medical men of recognized ability, based upon long and ample experience, competent to give expert consideration to all phases of the symptoms and course of yellow fever, in any form wherein the phenomena of the disease may present themselves, whether induced in the course of pestilential invasion, or in purposely devised inoculation.

Resolved, That this commission aforesaid shall proceed at the earliest possible moment to Rio de Janeiro, as the first field of its labors. Having completed there its work, it shall proceed to Mexico, and, if necessary in the accumulation of testimony, to Panama, Colon, and Havana.

Resolved, That the sum of $30,000, or so much thereof as may be actually required to pay the necessary and unavoidable travelling and other expenses, and the salaries of the members of the commission, be appropriated by congress.

Resolved, That the sum of $5000 shall be paid as a recompense to each member of the aforesaid commission.

XIII.

MARITIME SANITATION.

By S. T. ARMSTRONG, M. D., PH. D., Passed Assistant Surgeon United States Marine Hospital Service.

The question of maritime sanitation is closely connected with the commercial interests of the American people, related, as it is, to a marine commerce aggregating almost fifteen million tons, and a total value of exports and imports of over one and one half billion dollars. To-day we are in the same position as in 1879, when Dr. T. J. Turner, U. S. N., wrote,[1]—"No sanitary code exists at present in the naval or merchant marine, and much of the hygienic management of the sailor and his environments is still founded upon those vague quantities, the so-called usages and customs of the sea service."

It is the province of the sanitarian to indicate what measures are desirable to prevent this commerce becoming the means of introducing disease, as the proposition of Dr. Harvey E. Brown, U. S. A.,[2] "that, in the vast majority of epidemics, if not all, that have occurred in the United States, the germinal principle of the disease was imported from elsewhere, and was not due to local causes," is generally accepted as a veritable fact.

The factors to be considered in dealing with this subject are the sailor, the passenger, the cargo, the vessel, and the port. It will be impossible, in a paper necessarily limited as this is, to consider each of these topics *in extenso*. Allusion can only be made to the more important amendments of existing laws and customs concerning each of the factors referred to.

As in the days of Dr. Lind, "In the merchant service the condition of the poor mariner when at sea is often much to be pitied."[3] This sympathy has been echoed and supplemented by the work of Sir Gilbert Blaine, Welch, Judson, Hebersmith, Gihon, Bailhache, Wyman, and particularly by Mr. Plimsoll, who labored greatly for the amelioration of the seamen of British marine services.

[1] "A Treatise on Hygiene and Public Health," Hygiene of the Naval and Merchant Marine, T. J. Turner, A. M., M. D., Ph. D., Medical Director U. S. N., W. Wood & Co., New York, 1879, p. 177.

[2] "Report on Quarantine on the Southern and Gulf Coasts of the United States," Harvey E. Brown, Assistant Surgeon U. S. A., W. Wood & Co., New York, 1873.

[3] An essay on the "Most Effectual Means of Preserving the Health of Seamen in the Royal Navy," James Lind, M. D., F. R. C. S., Edinburgh, etc.; London, 1774.

In no vocation is the physical status of the individual of greater importance than in seafaring life. The sailor has not only need for alertness of every faculty, but every faculty must be an expression of a physically sound organism; and only such an organism is best prepared to resist the encroachment of disease. Furthermore, while the employer ashore can easily fill the place of an employé disabled by disease, the shipmaster at sea depends upon the preservation of the health of his crew for the safety of his passengers, cargo, and vessel. Mr. Plimsoll stated that ten per cent. of the men who ship are physically unfit for duty.

It was not until the present century had well advanced, that the excellent regulations of the navy for the physical examination of seamen, preparatory to enlistment, were perfected.[1] For ten years past the surgeon-general of the United States Marine Hospital Service has annually recommended the enactment of a similar law for the merchant marine; and, pending congressional action, the medical officers of that service have been directed to make a physical examination of any American seaman, either on the request of a shipping commissioner, agent, master, or the seaman himself. The privilege of this examination has been extended to the crews of foreign vessels. Yet in the fiscal year of 1884 only two hundred and twenty-eight seamen were examined for their fitness for service preliminary to shipment.[2] And so short-sighted are shipmasters in this matter, that within three years, in the United States revenue marine, the writer has known men to be shipped who were physically unfit for service. By virtue of the United States statutes, pilots are required to undergo examination for their color sense, but no such examination is required of seamen.

Aside from the interest of the sailor himself, who would be supposed to be desirous of avoiding a long voyage during which an inherent disease might be aggravated, and no remedial measures be at hand, the United States has an interest in the matter,—as a man might ship on a vessel, serve some sixty days, and then be admitted into a marine hospital for a case of consumption, cardiac trouble, or other permanent disability, not the result of employment on shipboard. In the interest of all parties concerned, it is to be hoped that this matter will receive early legislative action.

Another omission in the United States laws is the specification of the minimum cubic space for each seaman in the sleeping quarters of the crew. Even in the navy this varies from forty-five to one hundred and seventy-six cubic feet per capita in the forecastle;[3] and the writer has known of junior officers occupying a steerage where the space was quite as small as that first mentioned. In the merchant marine the space may be as small, and added thereto is a lack of light, no ventilation except by a hatch, dirty bunks or hammocks, and foul bedding, comprising a *tout*

[1] *Vide* "A Plan for the Internal Organization and Government of Marine Hospitals in the United States," William P. C. Barton, M. D., Surgeon U. S. N., Philadelphia, 1817.

[2] "Annual Report United States Marine Hospital Service," 1884.

[3] *Vide* Turner, op. ci., p. 179.

ensemble that would not be tolerated in even an averagely conducted penitentiary. In the interests of humanity alone it would be desirable to have the provisions of the law [1] apply to seamen as well as passengers, giving ninety-six cubic feet on the main deck, and one hundred and eight cubic feet on the lower deck, "not being an orlop deck," as the minimum space for each man; and further amending the statutes,[2] that such ventilators shall be employed as will extract the foul and introduce the fresh air at the rate of six hundred cubic feet per hour. In lieu of such ventilating apparatus, the allotted cubic space to be increased, stationary ventilators, air-ports, and wind-sails to be required as well.

By law all passenger vessels are required to have a water-closet for every hundred passengers. But no provision exists for the seamen, who, even on some men-of-war, are often compelled to climb over the bows. If all registered vessels were required to have some convenience, even if a simple porcelain-lined spout discharging through a forward scupper, as suggested by Surgeon-General J. B. Hamilton, U. S. M. H. S.,[3] it would decrease the liability to disease induced by constipation. Connected with this spout there should be a simple pump, for thorough cleansing. The latter could also be used for supplying water to a bath-tub, and the crew encouraged in personal ablution.

The question of clothing is an individual one, and climate necessitates proper attention to it. Masters of vessels bound on long voyages are required to carry a slop-chest, containing such wearing apparel as may be needed.

The quantity of food and water is specific in its minimum amount, and rarely, at the present day, is the ship-master so short-sighted as to provide poor quality of food for his men. Ship cooks are, as a general rule, better qualified for any position than the one they fill, and much of the digestive disorders of seamen is due to their inefficiency.

A ration of salt-water soap should be issued weekly, for washing the clothes and bedding of the crew; and at least monthly washings of the bunks, or hammocks, with a bi-chloride of mercury solution, would have the double effect of killing vermin and cleansing foul places.

For various reasons unnecessary for our consideration, much more has been done for the passenger than for the seaman. The legal regulation of the cubic air space, ventilation, the number of passengers to be carried, their food, water, and conveniences, exists. But there are two very important laws relating to passengers, which are not capable, as at present existing, of accomplishing the advantage originally intended. It is provided [4] that the collector of customs shall require an inspector to examine every passenger vessel, and report whether the foregoing laws have been complied with; and further, it is required [5] that "the collector

[1] Sec. 4252, United States Revised Statutes.

[2] Sec. 4257, United States Revised Statutes.

[3] "Hand-Book for the Ship's Medicine Chest," Washington, 1881, p. 5.

[4] Sec. 4264, Revised Statutes United States.

[5] Sec. 4272, Revised Statutes United States.

of customs shall examine each emigrant vessel on its arrival at his port, and report to the secretary of the treasury the time of sailing, the length of voyage, the ventilation, the number of passengers, their space on board, their food, the native country of the emigrants, the number of deaths, the age and sex of those who have died during the voyage, together with his opinion of the cause of the mortality, if any, on board, and if none, what precautionary measures, arrangements, or habits are supposed to have had any, and what, agency in causing the exemption." Compliance with these laws is perfunctory or insufficient; and it would scarcely seem that either of the officers named is best fitted to discharge such duties.

Maritime sanitation would be benefited, and the country at large less liable to imported disease, if these laws were amended, requiring the officer to be a medical officer of the treasury department. The law could be enforced, because it is at present an offence for a ship-master to neglect to keep his vessel in a sanitary condition, or to fail to post up directions requiring the observation of cleanliness by the passengers.

In cases of contagious disease, either among the crew or passengers, isolation, disinfection of the discharges, destruction of the bedding and clothing on recovery or death, and absolute cleanliness, should be enforced.

Not only rags and personal effects, but many other articles of merchandise, may be the carriers of the contagious principle. In consideration of the approved methods for disinfecting vessels, the necessity for breaking out a cargo, and transferring to lighters, has been claimed to be a supererogatory tax on either the merchant or the state; that the measures employed to disinfect the vessel will be, so far as prophylactic science proves, sufficient to disinfect the cargo.

In the case of wearing apparel, either immersion in a two per cent. bichloride of mercury solution, or fumigation with bichloride of mercury, sulphur, or superheated steam, will prove sufficient to destroy the contagious principle if existing, or be precautionary if it is suspected. Contrary to a preconceived opinion of the writer's, some experiments with various kinds of fabrics failed to show, except sometimes shrinkage from steam, any material change, as a result of the application of any of the above-named methods. Fumigation seems, however, the most desirable, as it may easily be applied for clothing, either in a cabin or in a tent, the wearing apparel suspended on bent wire hooks, and heat and vaporization of a disinfecting agent produced by a small stove or portable camp-stove.

Burning clothing or bedding, except mattresses, unless these are absolutely worthless, is like cutting the Gordian knot—the readiest, but not the best, means. In case of a cargo of rags, various plans have proved satisfactory, and the necessity for their disinfection has been insisted upon by sanitarians both of this country and of Europe. Any of the methods of disinfection referred to in treating of wearing apparel are applicable to this case.

Vegetable matter, moisture, and heat are the concomitants of a malarious country, and, with slight difference, these three associated causes exist in a ship, and, if not regarded, will engender a malarious atmosphere—a fitting *nidus* for receiving and propagating *materies morbi;* and, as in a village in a malarial country the public health may be improved and disease prevented by attention to sanitary principles, so on the vessel will vigilance and cleanliness be potent in preventing disease, or its extension if developed in an individual after embarking. An attempt is made to realize this condition by dragging a hose along the deck, usually about sunrise, thoroughly soaking that unoffending surface, and allowing the moisture to dry slowly. Notwithstanding all that has been written against this practice, which is extended to other parts of the vessel at variable intervals, it is a fetich apparently inseparable from the routine of ship's duty.

As early as the middle of the past century, Dr. Lind[1] protested against this pernicious custom; and Trotter, Sir Gilbert Blane, and, in fact, every writer on maritime hygiene to this day, has experienced, in condemning the usage, a consummation similar to Dr. Barton's, who said,[2] "I was never able to convince any one of the sea officers, with whom I conversed on this subject, of the injury resulting from this custom." Nothing but iteration and reiteration will secure what Dr. Turner[3] terms "the abandonment of this vestige of the deluge."

There is enough moisture in a ship from natural causes, and the aim of the master should be to keep his vessel as dry as is consistent with ordinary cleanliness. The bilges should be pumped clean at regular intervals, and flushed out with a solution of bichloride of mercury in water. In fair weather it is desirable to remove the hatches, and ventilate the hold with wind-sails, should no fixed ventilators exist.

The old custom of burning pitch or resin between decks is now rarely resorted to; but in hot latitudes, especially if the vessel has previously encountered rough weather, and consequently allowed the ingress of more or less water, after pumping clear, between deck-fires, with either sulphur or bichloride of mercury thrown on the coals, it will prove desirable to dry the vessel, and consequently diminish the tendency to disease in the crew. Should contagious diseases develop in the latter, if the vessel be a steamship, forcing the steam between decks into the cargo or ballast, and into the forecastle or cabin, will destroy the contagious principle. This has been satisfactorily demonstrated, in the case of yellow fever, by Dr. A. N. Bell, in the U. S. S. Vixen, in 1848, and in the case of cholera, by the medical officer of the U. S. S. Ossipee, during the past summer.

Experience with the U. S. S. Susquehanna in 1858, and the U. S. S. Plymouth in 1878–'9, demonstrated that cold would not destroy yellow

[1] Op. cit.

[2] Op. cit., p. 229.

[3] "Hygienic and Medical Reports, United States Navy," "Air and Moisture on Shipboard," Th. J. Turner, A. M., M. D., Ph. D., Washington, 1879, p. 684

fever contagion ; and this practical illustration was supported by the experiments of Professor McKendric, who reported, at the last meeting of the British association, that exposure of culture-fluids containing micro-organisms to a temperature of 120° below zero, for at least one hundred hours, would not destroy vitality. Professor Tyndall's experiments with heat proved it an effective destructive agent of micro-organic life.

"International sanitary action is too remote, and the steps toward it have been too vacillating in the past, to admit of much hope from it for the near future ;"[1] and the twelve years that have passed since these words were penned have resulted in no nearer approach to harmonious action. As there can be no coercion in a matter of this character outside of consular information of the prevalence of disease in a foreign port, it is necessary for United States ports to depend upon themselves.

Examination of vessels by United States officers, as previously indicated, reference again to the state officers,—for in this matter the autonomy of the state must not be lost sight of,—and disinfection by such means as it is seen fit to employ, comprehend the essential features of so-called quarantine. No reference will be made to this matter, as the president of the State Board of Health of Louisiana, whose plans have received the indorsement of the Sanitary Conference of State Boards of Health of the Gulf Coast,[2] will present at this meeting a paper on the most thorough means known to science to be applied to infected vessels, or vessels coming from infected ports.

It is of paramount importance that our maritime cities should be kept in proper sanitary condition ; and it is the aim of this association to effect, through its influence, this culmination. When this is attained, the danger from cholera, yellow fever, typhus fever, or small-pox, will be reduced to insignificance.

In making a summary of the indications for improvement, it may be broadly stated, in the conclusions of the late Surgeon-General J. M. Woodworth, U. S. M. H. S., adopted by the International Medical Congress of 1876,[3] that "the supervision of ocean travel ought to be directed to securing good sanitary conditions for vessels at all times, out of as well as in port."

By the law of February 23, 1799, all aid to health laws and local quarantine of any state shall be directed from time to time by the secretary of the treasury, and, in order that thorough work shall be attained, it would be desirable to have laws passed requiring,—

1. The physical examination of seamen, preliminary to shipment in a United States port.

[1] "The Cholera Epidemic of 1873 in the United States," Washington, 1875, Dr. John M. Wood worth, U. S. M. H. S., p. 13.

[2] "Proceedings of the Sanitary Conference of State Boards of Health," New Orleans, June, 1884.

[3] Transactions of the International Medical Congress. "The General Subject of Quarantine, with Particular Reference to Cholera and Yellow Fever." J. M. Woodworth & Co.

2. Amendment of the present laws, requiring an inspection of passenger and emigrant vessels, so that such an inspection may be made by a medical officer of the United States.

3. Distribution among ship-masters of sanitary tracts, as has been commenced by the surgeon-general of the Marine Hospital Service, briefly and lucidly setting forth the best and simplest means of keeping their vessels, passengers, and crew in a good sanitary condition.

XIV.

EXPERIMENTS IN DISINFECTING SEWERS.

By O. W. WIGHT, A. M., M. D., Health Officer of Detroit.

Last year it happened that rather strong reports in the newspapers of the rapid spread of cholera in Europe created public alarm, and the common council of the city of Detroit was suddenly aroused from its customary lethargy in regard to sanitary matters. The result was, that a special appropriation of $2,500 was made from the contingent fund, to be spent by the board of public works, under the direction of the health officer, to clean up the city. Considering the facts, that no appropriation for years had been made to clean alleys; that no provision had ever been made for removal of garbage; that the sewer system is among the worst; and that the area of the city was then over thirteen square miles, since increased to about twenty square miles,—it is quite obvious that we experienced no difficulty in finding ways to spend the sum placed at our disposal. As the good citizens of Detroit, actuated by the common dread of pestilence, and always contriving to keep their city looking tidy, even under circumstances of negligence by the municipal legislature, set themselves to cleaning the alleys, each one the little section adjoining his own premises, and to removing all filth and garbage from their back yards; as the health department had been for some time busy making house-to-house visitations, and ordering the removal of all accumulations in vaults, and the drainage of lots and basements befouled with stagnant water; as the board of public works vigorously bestirred itself in cleaning streets,—our special work, in pursuance of the extraordinary appropriation, seemed to be narrowed down to some care for the filthy and dangerous public sewers.

Detroit has no regular sewer system. The city is traversed by more than a score of great conduits, from four to eight feet in diameter, from two to seven miles in length. Most of them empty into the river submerged: consequently the dead water sets back in them from 1,000 to 5,000 feet. At their lower ends they are ordinarily choked with sediment, which is sometimes partly washed out in great storms. The submerged mouths are pretty effectually trapped, making these huge conduits receptacles for vast volumes of sewer gas. A rapid increase of water in the big sewers, during a summer shower, has sometimes caused such internal pressure of the confined air as to throw off covers from manholes in the streets. The effect on traps in the drains of houses can be easily imagined. The lateral sewers are constructed of common porous brick, thrown together by cheap workmen, and are all twenty

inches in diameter, whether designed to drain five acres or fifty acres. Sewer empties into sewer, frequently at right angles, sometimes at the top, sometimes at the bottom. Now and then a large sewer is connected with a smaller one. Here and there depressions allow the sewage to become ponded, and undergo putrefactive decomposition. In places, the constructors have evidently expected water to run up hill in obedience to the wishes of a favored contractor. Recently more than twenty large saw-logs were extracted from a single sewer, fifty or sixty rods back from the river. More than 10,000 vaults are connected with the sewers, for the most part by means of eight-inch clay or cement pipe laid without tight joints or traps. No wonder Detroit has annually more than 1,000 cases of diphtheria. Doctors there used to tell the people that they had the best sewer system in the world, and that their city was the healthiest in the United States.

Notwithstanding the fact that two medical men descended into one of the great sewers, remained there, to use their own language, "twenty-four consecutive minutes," and not only came out alive, but announced to an expectant public that the air therein was "chemically pure," I determined to disinfect the 200 miles of sewers, and see what would come of it. The two medical investigators seemed to be very much like a Mecklenburg gentleman, arraigned in my office on the complaint of his neighbors for maintaining a nuisance of hog manure piled up in his back yard. He solemnly assured me that he had a peculiar and precious breed of hogs that made sweet dung, and that his neighbors ought really to be grateful to him for affording them a bountiful supply of perfume, instead of complaining of him for making a nuisance; so I concluded to ascertain by actual experiment whether Detroit was really blessed with a breed of humans, or rather superhumans, whose sewage is "chemically pure."

The work of disinfection was begun with copperas. There are in the streets and alleys of the city of Detroit about 5,000 receiving basins communicating with the sewers. Into each of these were thrown a dozen pounds of copperas. To each school-house, police station, fire-engine house, and to every other public building, a barrel of copperas was sent at the city's expense. We used 75,000 pounds of copperas, purchased by the carload at $13 a ton. At the same time I made arrangements whereby citizens could purchase of a wholesale dealer copperas for one cent a pound. Proprietors of retail drug-stores, who had been in the habit of charging ten cents a pound for it, denounced me in bitter terms for interfering with their trade, till I threatened to expose their 1,200 per cent. profit on one of the necessaries of cleanly life, when they quietly subsided. As nearly as I could calculate, the citizens purchased and used about 200,000 pounds during the season. The direct and indirect effect on the sewers, from the use of nearly 140 tons of copperas, was to disinfect the sewage for several successive weeks. The citizens found so much comfort from the disinfection of their foul-smelling drains, that, with many of them, the use of copperas has become habitual. Some

families in Detroit consider a bag of copperas as much a household necessity as a bag of flour. It is very true that copperas, or any other disinfectant, is not a perfect substitute for good plumbing and proper drainage, but it does something toward remedying a prevalent unsanitary evil.

To destroy the poison in the confined foul air of sewers, also to kill the fungoid growths on their inner walls, a gaseous disinfectant is necessary. I therefore determined to fumigate the sewers with burning sulphur. Conservative citizens were sure it could not be done. "No practical man would think of trying it. The expounding of visionary theories might make very taking newspaper literature, but it would be an outrage on tax-payers to spend the public money in experiments condemned beforehand by 'common-sense.' How could a brimstone fire be kindled and kept going, down a sewer fifteen or twenty feet under the ground? And what good would it do anyway if you made a fire in such a place? The fire would be smothered for the want of air, and the damp would put it out. Would you build it on a raft, and let the raft float through a sewer? The raft would surely be upset, and the sulphur spilled into the sewage, making it smell worse than ever. Nothing could be more preposterous than an attempt to establish in that way a theological institution for the premature punishment of unconverted bacteria."

Nevertheless, as an orthodox sanitarian I determined to try the experiment, and let the heathen rage. Three tons of roll brimstone were purchased, at a total expense of $150. Fifty galvanized iron pails, called steamboat pails, were purchased, at 75 cents each. A sufficient quantity of light chain, and five dozen spikes, with hooks in the place of heads, were also purchased. Holes three quarters of an inch in diameter were punched in the iron pails, about two thirds of the way up from the bottom, two inches apart all the way around.

Procuring from the board of public works the services of two men experienced as to the location and construction of the sewers, loading up a wagon with a barrel of sulphur, a nest of pails perforated as aforesaid, a quantity of chain, a pair of nippers, a hammer, pick, shovel, crowbar, shavings, bundles of short wood fagots, and a barrel of charcoal, I started out amid the jeers of a disbelieving crowd of city officials.

With shovel, pick, and crowbar the cover of a manhole was lifted when we reached the place of our destination. A spike, with a hook on the end of it, was driven into the wall of the brick well, a foot or two below the top. The chain was fastened to the bail of an iron pail, and the same let down into the sewer so as to swing just clear of the sewage running in the bottom. The chain was then hooked on the spike already driven. The nippers served to cut off the chain above the hook. The pail was then drawn up, leaving the adjusted chain attached to its fastening. Into the pail were put, first, a handful of lighted shavings, then on the burning shavings some fagots of wood, and, lastly, on the igniting wood a small scoopful of charcoal. Over the pail was placed a sheet-iron cover, in the centre of which was inserted a single length of conical stove pipe, eight inches in diameter at the bottom and four at the top.

The air rushed through the holes punched in the pail, with a good draught, hastening combustion, and thereby saving time. As soon as the charcoal was thoroughly aglow the cover was removed, a dozen pounds of brimstone were thrown on the hot fire, and the pail, by means of its already adjusted and fastened chain, was quickly lowered into the sewer. It only remained to replace the cover of the manhole. We drove on to the next manhole, 400 or 500 feet away. Removal of the cover revealed not only smoke, but also a strong odor of brimstone. Sulphuric acid gas travelled in the sewer as fast as we did on the road.

The work went steadily on, day after day, till a pail of burning brimstone had been suspended down each one of the 500 manholes in the city. The pails were taken up the next day following suspension, and not unfrequently remnants of sulphur were found burning after twenty-four hours. Not a single pail missed fire. If ordinary means of igniting the brimstone had been used, there would have been many failures and much loss of time.

The odor of burning brimstone demonstrated to many a citizen that his drains and waste-pipes were not securely trapped against sewer gas. There resulted some funny scenes, affording us not a little merriment. For example, one huge German woman ran out of her privy, near by, exclaiming, "Hell is loose; der Teufel is come!"

When the work was completed the people were so convinced of its efficacy that the board of education resolved to have all the school buildings fumigated, in each of which, according to the size, were burned from thirty to eighty pounds of brimstone.

There followed the copious use of copperas and sulphur a great abatement of diphtheria, and an almost entire cessation of scarlet fever. Of course a single experiment does not warrant us in predicting a relation of cause and effect.

The whole expense for a single disinfection of the sewers with both copperas and burning brimstone was less than $1,300. With the money left out of the appropriation, we have this year repeated the experiment. Again we have treated the sewers of the city to 60,000 pounds of copperas and three tons of burning sulphur.

The board of education has adopted the plan of fumigating the school buildings twice a year. The second experiment was followed for a time with an almost complete cessation of diphtheria.

Again: I say that disinfection, however thorough, is only a temporary relief from a dangerous evil, and cannot be relied upon as a substitute for an unsound sewer system and radically defective house drainage. The expense is not great, and it may be used as a more or less valuable instrumentality in a season of epidemic peril.

I should add, in justice to Detroit, that the common council this year appropriated $13,000 to clean alleys, and $6,000 for a scow service to remove street sweepings and garbage to a safe place three miles down the river. The work of sanitation is advancing in the city, steadily and surely, although more slowly than an ardent health officer might desire.

XV.

OBSERVATIONS UPON THE CAPE FEAR RIVER AS A SOURCE OF WATER-SUPPLY.

By THOMAS F. WOOD, M. D.,
Wilmington, N. C.

Southern river water of the type of Dismal Swamp water,—water of a clear yellowish hue, known also as juniper and cypress swamp water, stained by flowing through a peaty soil,—has for a long time been held in high esteem by masters of vessels for supplies for long voyages. The current belief is, that this water, after long storage in casks and tanks, undergoes a process of rectification which insures its keeping properties indefinitely.

It is the purpose of this paper to set forth the experiences in the employment of a water of the Dismal Swamp type, taken from the North-east branch of the Cape Fear river, as a source of public supply, covering observations extending over a series of years. The Clarendon water-works has a pumping station on the east shore of this river, from which is taken the water which supplies the city of Wilmington.

It will be necessary to give a brief description of the North-east river, in order to get a sufficient knowledge of the character of this water. This river rises in Duplin county, and in its course flows through a country only a few feet above the sea-level. It drains an area of about 1,470 square miles, comprising the counties of Duplin, Pender, and New Hanover. The river and creeks tributary to it have swampy margins, draining cypress swamps of large extent. Cypress swamps are not exclusively wooded with cypress trees, as the name would imply, but pines *(Pinus Australis)*, black gums *(Nyssa)*, sweet gums *(Liquidambar Styraciflua)*, and dense undergrowths of smilax, andromedas, and ilexes also abound. One of the largest tributaries—Smith's creek and its branches—has its source about five miles from Wilmington. The river is about 450 feet wide at the pumping station of the water-works. The tide rises to a point forty miles beyond Wilmington, making in all seventy-five miles from the ocean. The average rise of the tide at the station is 3.75 feet. Directly opposite the pumping station, and for 500 yards below it, tide-water rice-fields skirt the river down to Point Peter, the junction of the North-east with the North-west or main branch of the Cape Fear river. Above the station two other rice-fields are located, deriving their tidal irrigation from the river.

Wilmington is located on the east side of the Cape Fear river proper,

with a water-front of two miles. The town is built upon a series of sand-dunes, with intervening brooks, the natural drainage, and most of these streams have been converted first into partially covered drains, and finally made to serve the double purpose of drains and sewers. These discharge their contents into the docks along the river-front. The sewer which discharges nearest to the pumping station is half a mile distant. The number of sewers discharging into the river front is fifteen, and the number of families using these sewers, 103, and in addition to them, two small hotels. The drainage of the east side is accomplished by a series of open ditches and natural streams. These streams and ditches eventually empty into Smith's creek, a tributary of the North-east river. On these streams are located four cemeteries, in varying degrees of proximity, and one or more slaughter-houses. By the course of these streams, about one half or two thirds of the town is engirdled, and the natural course of drainage east and west is directly or indirectly into the Cape Fear or its tributaries.

Cape Fear river water has been studied from many points of view, but not systematically, because the business interests involved were by no means identical with the sanitary interests.

Sources of Contamination. The amount of sewage matter which is emptied into the Cape Fear river has never been made apparent by chemical examination of water taken at the pumping station. The following table of analyses made, while small, may be taken as an average of the albuminoid ammonia and chlorine. The analyses were done at the Agricultural Department of the state, after the Wanklyn method.

	Total Solids. Grs. per Gallon.	Chlorine. Grs. per Gallon.	Free Ammonia. Parts per Mill'n.	Albuminoid A. Parts per Mill'n.
1881.				
February 24, . .	6.2	0.6	0.05	0.26
1882.				
August 30, . .	9.10	0.52	0.014	0.50
August 30, . .	11.10	0.53	0.04	0.36
September 18, .	6.70	0.23	0.08	0.48
September 18, .	10.60	0.69	0.24	0.24
September 18, .	7.40	0.29	0.08	0.40
November 21, .	6.90	1.31	0.00	0.10
November 21, .	7.50	0.49	0.00	0.20
November 21, .	9.60	0.45	0.00	0.46
November 21, .	8.20	0.48	0.00	0.42

Sewage contamination may almost be excluded by the above showing, and the nitrogenous element, as small as it is, may be accounted for by

the decomposition of vegetable matter. One source of vegetable decomposition is from the discharge of water from the rice-fields during the "short" and "long flow." The "short flow" is the technical name for the flooding which is first employed for the germination of seed. The water is let in through flood-gates at high tide, so that it covers the rice about four inches, and is kept in this state until the seed germinates. The "long flow" is the admission of water in the same manner as above, and is intended to kill the grass after the first hoeing of the young rice. The water is just deep enough to hasten growth and decomposition under the influence of an early spring sun, and consequently a large amount of water laden with the products of decomposition is discharged into the river. Another washing is resorted to, by admitting one tide into the rice-field trunks and ditches to give them a thorough cleansing. The soil of tide-water rice-fields consists of deposits brought down by freshets from the hill country, which has been deposited layer by layer. It consists largely of organic matter, and supports a very rank growth of grasses, sedges, and succulent aquatic plants, such as Saggitaria and Orontium.

Factories. There is no pollution from factories along the river-front, the gas-house being the only establishment which discharges its contents into the river. Sulphuretted hydrogren has been discovered in the river opposite Castle street dock, at which point the gas-house is located.

Tar, Crude Turpentine, and Spirits of Turpentine. These articles may not be classed under the head of contaminating agents, but may prove a source of perplexity, as will be shown further on. For a century the products of the pine tree have been shipped from this port, and, by the accidents of handling and shipping, an unnumbered amount of barrels have been lost in the river. Of these, tar and crude turpentine are most tenacious when sunk in the river-bed of mud to the depth of twenty to thirty feet. The abundance of the accumulations of these products in the river may be illustrated by the following simple experiment: On a calm day in summer, if a pole be shoved deeply into the mud, and the mud stirred, very soon there follows a play of iridescent film upon the surface, emitting a distinct odor of tar or turpentine. These matters, if at all noxious or noisome, are fortunately insoluble.

The Temperature of the Water and Atmosphere. The purity of river-water must be largely influenced by the variations of temperature, and especially do high temperatures promote decomposition and increase the solvent power of water. Mr. John C. Chase, superintendent of the Clarendon water-works, has kept the record of the temperature of the water and atmosphere. The lowest temperature of water was February 21st, 43° Fahr., the atmosphere being the same day at the lowest, 33° Fahr. The highest temperature attained was July 23, when the water registered 83° Fahr., and the air the same day 96° Fahr. This was the highest temperature of the air for the year, although there is a higher record for water, viz., 86° Fahr., twice in August.

TEMPERATURES FOR MARCH, APRIL, MAY, AND JUNE, 1884.

Taken at 12 o'clock.

March.	A.	W.	April.	A.	W.	May.	A.	W.	June.	A.	W.
1	43	48	1	78	60	1	79	63	1	75	75
2	45	49	2	76	60	2	84	64	2	74	74
3	50	49	3	43	61	3	83	64	3	79	73
4	40	48	4	48	60	4	86	65	4	83	73
5	65	48	5	70	60	5	87	66	5	85	73
6	67	49	6	64	61	6	86	66	6	86	74
7	68	49	7	66	61	7	84	67	7	85	74
8	76	50	8	74	61	8	88	68	8	86	75
9	72	50	9	57	61	9	80	68	9	82	75
10	46	50	10	58	61	10	78	69	10	84	75
11	70	51	11	58	60	11	86	69	11	84	76
12	74	51	12	65	60	12	81	70	12	83	76
13	49	50	13	67	61	13	87	70	13	84	77
14	52	51	14	66	60	14	88	71	14	78	77
15	52	51	15	62	61	15	76	71	15	77	78
16	58	52	16	80	62	16	78	72	16	78	78
17	68	52	17	68	62	17	76	72	17	79	78
18	65	53	18	72	63	18	82	72	18	87	78
19	75	53	19	72	63	19	86	73	19	86	78
20	72	54	20	75	64	20	84	73	20	88	78
21	68	54	21	66	64	21	85	74	21	91	79
22	68	55	22	58	63	22	88	74	22	88	79
23	64	55	23	60	63	23	86	75	23	85	79
24	74	56	24	59	62	24	89	75	24	80	79
25	80	56	25	64	62	25	88	76	25	85	78
26	70	57	26	68	61	26	83	76	26	86	78
27	68	57	27	74	61	27	79	77	27	73	79
28	75	58	28	82	62	28	79	77	28	74	78
29	72	58	29	82	62	29	73	77	29	75	78
30	63	59	30	78	62	30	72	76	30	83	78
31	58	59				31	77	76			

TEMPERATURES FOR JULY, AUGUST, SEPTEMBER, AND OCTOBER, 1884.

July.	A.	W.	August.	A.	W.	Sept.	A.	W.	October.	A.	W.
1	82	79	1	86	83	1	85	83	1	87	76
2	78	78	2	82	82	2	84	84	2	88	77
3	86	78	3	88	82	3	86	83	3	84	78
4	79	78	4	79	81	4	88	83	4	86	79
5	86	78	5	88	82	5	86	82	5	89	80
6	86	78	6	80	81	6	86	82	6	92	81
7	86	78	7	87	81	7	89	82	7	87	80
8	81	77	8	86	81	8	86	82	8	76	79
9	83	78	9	79	80	9	86	82	9	80	79
10	86	78	10	76	80	10	83	81	10	78	79
11	75	77	11	78	79	11	79	81	11	76	79
12	88	78	12	81	79	12	74	80	12	83	78
13	96	78	13	76	79	13	78	80	13	82	78
14	91	79	14	82	79	14	72	79	14	77	77
15	92	80	15	83	78	15	77	79	15	66	76
16	93	80	16	85	78	16	81	79	16	75	76
17	85	81	17	82	78	17	83	78	17	75	75

TEMPERATURES FOR JULY, AUGUST, SEPTEMBER, AND OCTOBER, 1884—*continued.*

July.	A.	W.	August.	A.	W.	Sept.	A.	W.	October.	A.	W.
18	89	81	18	83	78	18	84	78	18	76	75
19	86	81	19	89	78	19	79	77	19	75	74
20	87	81	20	89	79	20	86	77	20	75	74
21	85	81	21	89	79	21	83	76	21	76	73
22	88	82	22	89	79	22	82	76	22	81	73
23	92	82	23	87	79	23	82	75	23	69	72
24	94	82	24	92	80	24	82	75	24	54	71
25	94	82	25	85	80	25	83	74	25	66	70
26	90	82	26	85	80	26	84	74	26	67	70
27	88	82	27	81	81	27	82	75	27	75	69
28	81	82	28	86	81	28	88	75	28	82	69
29	85	83	29	88	82	29	88	76	29	74	68
30	90	83	30	90	83	30	89	76	30	66	68
31	88	83	31	92	83				31	57	66

TEMPERATURES FOR NOVEMBER AND DECEMBER, 1884, AND JANUARY AND FEBRUARY, 1885.

Put on new thermometer (old one lost) Nov. 1.

Nov.	A.	W.	Dec.	A.	W.	Jan.	A.	W.	Feb.	A.	W.
1	69	66	1	53	57	1	72	49	1	52	47
2	76	66	2	53	57	2	38	49	2	42	47
3	70	66	3	52	56	3	37	48	3	58	47
4	74	65	4	60	55	4	40	48	4	57	47
5	61	64	5	62	55	5	55	47	5	56	47
6	53	63	6	74	54	6	71	47	6	44	47
7	53	62	7	65	55	7	54	47	7	67	47
8	59	62	8	64	55	8	55	48	8	56	48
9	66	61	9	65	56	9	65	48	9	62	48
10	68	61	10	65	56	10	58	49	10	46	48
11	70	61	11	65	56	11	66	49	11	27	48
12	71	61	12	72	56	12	67	50	12	44	48
13	74	61	13	55	56	13	58	50	13	36	47
14	66	61	14	53	56	14	55	50	14	37	46
15	70	61	15	70	56	15	70	50	15	37	45
16	69	60	16	51	55	16	74	51	16	48	45
17	65	60	17	62	55	17	48	50	17	48	45
18	71	59	18	52	54	18	36	50	18	52	44
19	69	59	19	24	50	19	35	49	19	36	43
20	53	58	20	29	49	20	38	49	20	34	42
21	58	58	21	48	49	21	41	48	21	33	42
22	69	59	22	64	49	22	34	48	22	41	43
23	69	58	23	53	49	23	34	48	23	36	42
24	55	58	24	42	49	24	61	48	24	48	42
25	53	58	25	45	49	25	56	48	25	45	43
26	62	58	26	32	48	26	43	49	26	43	43
27	64	58	27	38	48	27	52	49	27	50	44
28	66	58	28	48	48	28	55	48	28	60	44
29	59	58	29	64	48	29	40	47			
30	60	58	30	69	48	30	62	47			
			31	74	48	31	53	46			

TEMPERATURES FOR MARCH, APRIL, MAY, AND JUNE, 1885.

March.	A.	W.	April.	A.	W.	May.	A.	W.	June.	A.	W.
1	63	45	1	76	53	1	78	67	1	81	77
2	49	45	2	72	54	2	70	67	2	88	78
3	57	46	3	69	54	3	70	68	3	88	78
4	67	47	4	60	55	4	76	68	4	85	78
5	55	47	5	57	55	5	79	69	5	88	78
6	57	47	6	76	56	6	69	69	6	77	77
7	60	48	7	76	57	7	83	70	7	85	77
8	47	48	8	74	57	8	80	70	8	87	77
9	43	48	9	62	58	9	78	71	9	77	77
10	63	49	10	49	59	10	67	70	10	68	76
11	58	49	11	60	59	11	72	70	11	76	76
12	52	50	12	63	60	12	74	70	12	82	75
13	43	50	13	63	60	13	69	70	13	83	75
14	47	50	14	54	60	14	69	70	14	88	76
15	66	50	15	68	61	15	75	70	15	87	76
16	52	51	16	81	61	16	78	71	16	87	77
17	....	.....	17	62	61	17	66	70	17	84	77
18	34	51	18	58	61	18	73	70	18	78	78
19	52	51	19	68	61	19	81	70	19	81	78
20	44	51	20	72	61	20	83	71	20	83	79
21	48	51	21	75	62	21	87	71	21	86	79
22	38	50	22	81	62	22	85	72	22	89	79
23	36	50	23	83	63	23	84	72	23	88	79
24	43	50	24	83	63	24	85	73	24	81	79
25	60	49	25	83	64	25	89	74	25	82	79
26	64	50	26	84	64	26	88	74	26	89	79
27	62	50	27	76	65	27	86	75	27	87	79
28	67	50	28	76	65	28	83	75	28	88	80
29	43	51	29	76	66	29	82	76	29	90	81
30	56	51	30	77	66	30	82	76	30	77	81
31	71	52				31	86	77			

TEMPERATURES FOR JULY, AUGUST, SEPTEMBER, AND OCTOBER, 1885.

July.	A.	W.	August.	A.	W.	Sept.	A.	W.	October.	A.	W.
1	77	80	1	90	85	1	82	83	1	70	73
2	79	80	2	84	85	2	77	82	2	70	72
3	83	80	3	89	85	3	85	82	3	82	72
4	86	80	4	86	85	4	82	81	4	75	72
5	82	81	5	90	86	5	83	81	5	69	72
6	90	81	6	91	86	6	75	81	6	57	71
7	91	82	7	92	85	7	78	81	7	66	71
8	92	82	8	88	85	8	84	80	8	73	70
9	93	82	9	87	85	9	88	80	9	66	69
10	92	82	10	87	85	10	84	79	10	76	69
11	91	82	11	92	85	11	82	79	11	64	68
12	85	82	12	91	85	12	85	79	12	67	68
13	85	82	13	92	85	13	86	79	13	66	68
14	86	82	14	88	85	14	86	79	14	72	68
15	89	82	15	79	84	15	84	79	15	76	68
16	89	82	16	82	84	16	89	79	16	72	68
17	87	83	17	88	84	17	84	80	17	76	68
18	90	83	18	86	84	18	81	80	18	76	68
19	85	83	19	91	84	19	82	80	19	81	68

TEMPERATURES FOR JULY, AUGUST, SEPTEMBER, AND OCTOBER, 1885—*continued.*

July.	A.	W.	August.	A.	W.	Sept.	A.	W.	October.	A.	W.
20	76	83	20	91	85	20	83	80	20	80	68
21	91	83	21	90	85	21	71	80	21	80	68
22	92	83	22	90	85	22	68	79	22	58	67
23	96	83	23	84	85	23	70	79	23	59	67
24	90	83	24	86	85	24	72	78	24	63	66
25	89	83	25	90	85	25	82	77	25	64	65
26	92	84	26	81	84	26	79	77	26	64	64
27	91	84	27	75	84	27	76	76	27	70	64
28	91	84	28	79	83	28	81	75	28	68	64
29	91	84	29	84	83	29	76	74	29	70	64
30	91	85	30	73	82	30	78	74	30	64	64
31	90	85	31	71	82				31	54	63

TEMPERATURES FOR NOVEMBER, 1885.

Nov.	A.	W.	Nov.	A.	W.	Nov.	A.	W.	Nov.	A.	W.
1	74	63	7	81	61	13	75	62	19	73	60
2	59	62	8	72	62	14	61	62	20	65	60
3	52	61	9	61	62	15	58	61	21	53	59
4	64	61	10	57	61	16	65	61	22	68	59
5	78	61	11	65	61	17	58	61	23	70	58
6	79	61	12	74	61	18	65	61			

Description of the Water. This water is generally clear, and has a color from pale to deep amber, which color is not discharged by sedimentation. It is free from odor, either when allowed free access to the air, or after bottling or closing up in casks for years. The sediment is a finely divided mud, chiefly consisting of silica and alumina. It has the merest trace of lime or other mineral constituents.

The exception to this last statement is, that during long protracted drouths the access of brackish water at Wilmington from the ocean, thirty miles away, is sufficient to allure crabs, shrimps, and mullets into the water at this point. During such seasons, while there has been an amount of salt as high as fifty or sixty grains to the gallon, no saline taste was imparted.

The coloring matter in the water is one of the marked peculiarities, and in some respects one of the gravest objections to its use for manufacturing purposes, and making it also unattractive for household purposes. The source of the coloring matter is the decomposing leaves, the roots of many trees, such as the pine and cypress, and such matters as are washed out from peaty soil. The latter alone, which is but a soil containing highly carbonized remains of leaves, roots, sphagnum, moss, etc., may impart this color to the water. It is not possible by ordinary filtration to discharge this color without the aid of chemicals, and, as before stated, sedimentation has no effect upon it.

The keeping properties of this water, when confined for a long time in

closed vessels, is probably due to the very ingredient which gives it its color. This theory is consonant with practical experiences in the employment of vegetable substances, such as salicylic acid, for the prevention and arrest of fermentation.

Filtration. Filtration has been experimented with upon a large scale, the desideratum, of course, being to deliver a "white" water in the mains to consumers. As mentioned before, filtration and sedimentation, without the employment of chemicals, did not change the color of the water, and practically was not worth the expense involved. The basis of all the experiments was the property that commercial alum had in depriving the water of its color. The process consists in passing a volume of water through white sand, at the same time causing a solution of alum and a small portion of lime to filter through with the water. The water discharged when the proportion of the chemicals was correctly adjusted was white, odorless, and tasteless. It was discovered that this filtered water, although not having any taste of alum, could be used upon an unfiltered bulk of water and still exert a degree of decoloration. One sample of this filtered water may serve to convey an idea. Chemical analysis gave the following:

	Grains per gallon.
Total solids	10.35
Consisting of chlorine	1.57
Volatile organic matter	1.45
Alumina (equivalent to 5.35 grains)	.65
Sulphuric acid (equivalent to 6.07 grains)	

Another specimen of unfiltered water from the same source as above gave,—

	Grains per gallon.
Total solids	11.18
Solids in suspension	.10
Chlorine	2.50
Volatile organic matter	2.88
Alumina (equivalent to alum, .8234 grains)	.10
Sulphuric acid (equivalent to alum, 1.13 grains)	.47

Deducting the alumina and sulphuric acid equivalents of alum naturally existing from the above, it gives 9.46 grains per gallon; and, small as this is, it still possesses the property of coagulating and precipitating unfiltered water. The amount of alum so far used is too large, both in an economical point of view and chemically, to produce perfect results. It will probably be ascertained that the process of decoloration will be more economically and effectively accomplished in large settling basins, the chemical action going on more thoroughly in still water, after the alum is thoroughly mixed. The application of alum as above is not a new process, for it has been used as a domestic remedy for undrinkable water in Richmond and other cities where turbid river-water is frequently delivered for consumption. None of the patented filters so far prove

satisfactory on the large scale, although a few have succeeded in giving a very good result for domestic purposes. Numerous experiments are being pursued with good promise of success; and when that day comes, Southern tide-water rivers will be far more valued for public supply.

An Accidental Chemical Experiment on a Large Scale. During this year an ice factory was erected at Wilmington. The question of water-supply in proximity to transportation was the practical fact upon which the success of the venture depended. The factory was located on the Wilmington & Weldon Railroad, near the foot of a deep cut, down which a good stream of water flowed from a spring tapped in cutting the roadway through a sand hill. This water it was hoped would be adequate to the demand; but in the meantime river water, as delivered to consumers in Wilmington, was submitted to a chemist for his opinion as to its fitness for the purpose of ice-making, after distillation. The reply of the chemist was in the affirmative. The experiences of the manufacturer are intelligently written, and are here submitted:

WILMINGTON, N. C., November 21, 1885.

DR. T. F. WOOD:

Dear Sir:—We use what is known as the ammonia absorption process for making ice. We take ordinary aqua ammonia, 26° B., and distil off the ammonia gas at a pressure of 180 pounds. We pass this gas through 1,700 feet of piping submerged in cool water: there the gas, under 180 pounds pressure, liquefies. We then liberate the liquid gas into 3,000 feet of iron pipe, submerged in strong salt brine (90°), into which brine we set the cans containing the water to be frozen. The instant the liquid (anhydrous ammonia) is liberated it turns into gas, and as the gas expands it absorbs the heat from the salt water, that in turn taking the heat from the water in the cans, making ice. The gas discharges from the 3,000 feet of pipe into what is known as an absorber, containing a quantity of pipe, through which water constantly flows. The heat that is taken up by the gas is there absorbed by the water and discharged with it, the gas becoming aqua ammonia again. The cans in which the ice is frozen are placed in the freezing-tank containing the salt brine, and filled with distilled water. The freezing begins around the outside of the cans and at the bottom, and continues to the centre, the grain of the ice tending to the centre from all sides. It takes forty-eight hours to freeze one can solid, and we have 204 cans under process of freezing all the time. After being in twenty-four hours, the ice is about five inches thick on all sides of the can. The top end is the last part to freeze. The blocks of ice weigh 225 pounds.

I first used the river water for making ice. Frozen in its natural state, the ice is dark and unsightly. I tried condensing a gallon, using an ordinary tea-kettle for boiler, and condensed the steam in a tin funnel about two feet long. The condensed water thus obtained was white, and to taste and analysis pure. We used the river water for about a week, when I noticed the condensed water had a green cast and a peculiar taste, which was attributed to the iron, as our boiler was new, of forty horse-power, and the steam being condensed passed through nearly 2,000 feet of pipe. That was new. This taste intensified rather than diminished as we proceeded, and the water showed more color. All this time, about two weeks, we "blew" the boiler every four hours, about 250 gallons of water being discharged from the boiler each time. As an experiment, we ran twenty-four hours without blowing the boiler, by which time the condensed water had assumed a decidedly green cast, and made green ice,—not as highly colored as grass, but decidedly green. We then shut down, and blew all the water out of the boiler. This water was the color of lye, exceedingly soft to the hand, smarting severely when it came in contact with a cut or bruised place on the skin, and killed a number of eels in the small stream into which it discharged. We then filled the boiler with water taken from this stream, and

went to work again, when we made ice as clear as crystal, and the ice and condensed water were absolutely free from taste.

The temperature of this water increased as the summer advanced, and we saw clearly that cooler water was an absolute necessity, and we proceeded to dig a well. In order to expedite the work, we had to take up our suction-pipe to rig a siphon, forcing us again to use the river water, and this time for six weeks. We soon observed the same taste and peculiarity of the condensed water; and in order to overcome the difficulty, if possible, blew the boiler every *two* hours. Still the same taste. Three weeks of steady work developed another change. The ice came out with a decidedly colored core in the centre, which core, when cut open, emitted a strong woody or creosote smell. This core gradually grew from an inch in diameter to four inches in diameter; and with the increase in size came a corresponding increase in taste and smell,—so strong, indeed, as to lead a good many persons to believe the ice to be impregnated with creosote. I cut the core out of one block and melted it in a clean bucket. The water so obtained was of a more decidedly greenish cast than the river water, with a very strong taste of wood or creosote. The odor was very similar to decayed cypress or juniper.

We carry 100 to 110 pounds of steam on our boiler. This gives a temperature in the boiler of from 350° to 400° of heat, of course causing destructive distillation. I should not forget to mention, that, during the process of freezing, first would appear an oily substance on top of the water, which gradually assumed a dark color. By the time six inches of ice had formed, this substance would be in a mass about the centre of the water, and also line the inside of the ice from the bottom to the top, evidently being expelled from the water by the process of freezing. When the block of ice was nearly solid it would appear on top of the water in a small, round patch about the size of an ordinary tea-cup. We finished our well after six weeks' use of the river water. From the well we obtain white water, and have ever since made translucent ice, absolutely free from taste,—proving conclusively that the trouble was from the water and not from the machine, and that the destructive distillation made apparent impurities in the river water not developed by chemical analysis.

Yours, truly, WILLIAM E. WORTH.

This very expensive involuntary experiment brought to light qualities of the Cape Fear river water and its sediment which had never before been a matter of conjecture. The distillation of the first few days yielded a clear, good water, but as the sediment accumulated in the boiler, distillation at 350° to 400° Fahr. sent over in vapor a tar product, which imparted to the ice a peculiar taste of creosote. This product, collected from the water while in the freezing-bath, was brown, in globules, of a pungent odor, only slightly soluble in cold or boiling alcohol and in chloroform. In freezing it imparted to the ice a cloudy streak, radiating from the centre of the block. The taste of this part of the ice was very unpleasant, but it did not permeate the whole block, and the line of contamination could be easily traced, so that in sending it out to consumers this part was chipped out.

There are two explanations of the source of this tarry product. I think it was demonstrated by the manufacturer that the error did not take place in the process of making, as all contamination ceased as soon as other water was substituted for river water. Of the two sources of the tar product occurring in the condensed water, it may be that the peaty sediment which accumulated in the boiler might have furnished it. It is more highly probable, though, that the mud of the river, long impregnated with tar and turpentine, precipitating and accumulating in the

boiler, yielded under destructive distillation, at 400° Fahr., the product in question.

This paper has been presented to show some of the difficulties to be overcome in locating a source of public water-supply in the south Atlantic seaboard. The waters of the lakes and ponds are quite similar to the rivers, and it is a very exceptional pond or lake or spring in this locality that would furnish a white water in sufficient quantity for public supply. Sewage contamination is not a difficulty of immediate but rather of prospective importance, and, because of the sparseness of Southern population, more easily controlled.

The high temperature, though, which running streams attain,—86° Fahr., and higher, no doubt, if a sufficient number of observations were made,—shows how large an element of decomposition is at work during the prolonged hot weather, suggesting the great importance of excluding decomposable matter from the source of water-supply, and the additional precaution of securing water from the deepest streams or ponds.

The chief obstacle to a wise selection of a water-supply is the money element, which, at a very early period of the agitation of the question of water-works, enters into and controls the project. The question is very seldom a sanitary one, but one of profit to investors. Some of our Southern towns contemplating water-works could well study the experience of other Southern towns that have already established a water-supply. They will find that public opinion and sanitary advice have seldom influenced the course of a water-works company, and just now more than one Southern city is perplexed with the difficulties brought upon them by false steps taken in the selection of their source of supply.

There is still another aspect of the question of Southern water-supply which I will merely touch upon at present—the practicability of deep wells as a substitute for river water. Several Southern cities have succeeded in getting artesian water, but none so far of sufficient purity to be unobjectionable. So far as the experience in Wilmington goes, the water from deep wells is very hard, with the exception of the one dug by Mr. Worth. This water is somewhat hard, but in the hottest days the temperature of it was at an average of 63° Fahr.,—a feature of superiority over the river water, to say nothing of its freedom from organic impurities.

XVI.

RANDOM NOTES FOR PROMOTING THE HYGIENE OF THE DWELLING.

By GEORGE N. BELL, Sanitary Engineer,
Newport, R. I.

The hygiene of the dwelling is too elaborate a subject to be covered in one essay, and the amount of literature is already so voluminous that every detail has been somewhere described, discussed, and illustrated.

However, as the inspecting engineer of the Newport Sanitary Protection Association, as well as in my professional capacity as a sanitary engineer, I have had occasion to make inspections among a class of houses which probably rank among the best in everything else but hygienic conditions, and some of the practical work which it has been my duty to do may be of interest.

The population of Newport, as is well known, greatly increased on the arrival of the colony of cottage owners, and a great amount of the real estate business is the leasing of summer residences to regular patrons. If a party desires to rent a house for the season, be he in Washington, New York, or elsewhere, it does not follow that he comes to Newport for the sake of looking at the houses, but it is generally left to the agent as to the matter of location, furniture, conveniences at hand, etc.

After selecting a house in this way, by correspondence, and being prepared to sign the lease, it *then* occurs to him, if at all, to inquire into the sanitary condition of the premises, and an inspection is ordered. Now comes the responsible position of the inspector. The house must be pronounced either safe or unsafe for residence. If unsafe, a rental is spoiled, unless the owner sees fit to carry out such recommendations as are called for to make it safe.

To draw the line and say what shall be considered safe, has sometimes been a problem requiring judgment open to invoke criticism from one side or the other. A man having a house to rent is not always thoughtful of its sanitary condition, and if no bad smells have previously been perceived, he is loath to make any alteration; and when a rental hinges on the fulfilment of the recommendations offered, he frequently lets it go in the hope of some one's coming along who does not think of such matters. But the number of such men, I am happy to state, is getting less and less each year; and now one real estate firm have taken the stand that they will not act as agents to bother about houses which are not in

good sanitary condition, and the number of their rentals last year nearly equalled that of all the others put together.

In reviewing the reports of my inspections, I find that my chief work has been a continual effort against pan water-closets and unventilated soil-pipes; and of houses located on streets where there were no sewers, the offensive and dangerous cesspool has too frequently been found.

A few months ago I was called upon to make an examination of an estate located on the shore, which had been examined by me about four years ago, just after an outbreak of diphtheria. The conditions found at that time in and about the dwelling and gardener's cottage were bad in every way, embracing broken waste-pipes, worn out fixtures, unventilated soil-pipes, pan water-closets, and also a leaking cesspool within ten feet of the cellar wall of the cottage. Six deaths had occurred in less than four months. Added to other recommendations was one to clean out the cesspool and excavate all the surrounding earth which was in any way impregnated, and to fill the hole with clean earth mixed with lime. A month later, on examination, I was surprised to find the same cesspool in use, although most of the other recommendations had been carried out. The cesspool had been filled up, and a box privy placed outside. But the servants occupying the cottage began to throw slops upon the ground, and the hired man about the place thought it better to restore the cesspool, and so dug the earth out again; but at last I have the satisfaction of knowing that it has again been done away with, and a small brick tank, lined with cement and provided with a siphon overflow discharging into subsoil irrigation pipe located about forty feet from the cottage, substituted.

Last spring, in corresponding with an owner of a handsome residence, it was suggested that in my capacity as sanitary engineer one of the branches of my business was the sanitary care of premises, or, in other words, to see that the house was safe for occupancy before moving into it for the season. The idea did not at first take hold of him, as his family had occupied the house the previous season, and they had not noticed anything out of the way. Three days before the contemplated arrival of the family a letter was received from the owner, saying that he would be glad to have me look over the house, and drop a note to him if anything was to be done, at the same time thanking me for the suggestion. My *necessarily* hasty examination disclosed leaky waste-pipes and washtubs, old pan water-closets with the old-fashioned D traps, and a cesspool filled with putrefying matter, within ten feet of the house, the existence of which was not previously known. In reply to my letter, informing him of the facts, I received a dispatch to have all necessary repairs done at once. Here was a handsome residence, located on a high hill, commanding an expansive view of Narragansett bay, with every natural advantage for pleasure and comfort, but wholly lacking in the chief characteristic for fulfilling the object to be attained by a summer's sojourn.

Word to have things attended to *at once* was received too late on a Saturday to have much done before the receipt of a note from the owner,

on the following Monday, who had arrived with his family, though I was glad of the opportunity to *point out* to him the true state of affairs. He needed but to see to be convinced; and though a houseful of company was expected within a week, the work of repairing was forthwith begun. The leaky wooden washtubs were taken away, and in their place a set of three porcelain tubs was put in. The four-inch iron pipe, into which the wastes from the kitchen and pantry sinks discharged, was displaced by a two-inch lead pipe, laid on boards, and carried against the wall of the cellar, with all of the pitch the height of the cellar would admit of. Lead pipe was used on account of its smoothness inside and the ease with which it could be manipulated, all turns or bends being easily made by previously filling the pipe with sand. The waste from the kitchen sink entered this line of pipe in a quarter bend, at right angles to the line of pipe from the pantry sink, the two separate wastes being respectively six and eight feet long. At their point of junction with the two-inch pipe, a two-inch iron vent-pipe was carried up through the roof of the house to prevent siphonage of the S traps underneath the fixtures. It is my practice never to ventilate or *back-air* a trap underneath the kitchen sink, unless the chances of siphonage are frequent. With an unventilated S or half-S trap, taking into consideration the almost constant use of the fixture, the grease from the sink is less apt to congeal; and with as short a run as possible to the main line of soil-pipe, which is carried up to the roof, there is no danger to be apprehended from sewer gas escaping into the house through this medium, or any possibility of stoppage in the pipes.

For the pan water-closets, with their D traps, was substituted the "Brighton washout," with separate service cistern. This closet, with trap, is made in one piece, of English earthenware, with a perforated flushing rim provided with two arms, so that the flush enters at the back, and, in being carried around the top of the bowl to the opposite side, a heavy dash of water washes the side of the bowl, while the main flush is directly opposite the outlet at the back, and everything is forcibly ejected into the trap, and the greatest amount of washing-out force is secured, with a relatively small amount of water. Provision is made to secure what is called the local vent to take off any odor while the closet is in use.

Eleven cart-loads of material were taken from the cesspool, and I was glad to find it had been well constructed of brick, lined with Portland cement, and made perfectly tight. The amount of water used on and about premises of this kind is so great that it was thought to be a good plan to make a storage tank for water, to be used on the lawn and flower-beds, and let the first washings from the roof enter it. The old cesspool was utilized for this purpose. After disinfecting and scraping the sides and bottom as clean as possible, a man was sent down with a hand broom and a strong solution of caustic potash, which he vigorously applied for about four hours, so that every particle of grease was removed. After filling it with clean water and again pumping it out, it was possi-

ble to build up inside an additional course of brick. This was lined with Portland cement, making a very good storage tank. On a plan of the estate, showing the location of all pipes underground, this cistern was marked, "Not to be used for anything but garden purposes."

The connections with this old cesspool were with a drain discharging into another existing cesspool, located one hundred and twenty-five feet from the house, which it was impracticable at the time to have removed.

What I would have liked to do, had there been time, would have been to put in a "Powers Patent Disinfecting Tank," which I have found to be the best means for disposing of sewage from isolated houses. This apparatus consists of a shallow tank, usually built up with brick, lined with Portland cement, and partitioned to form what is called the receiving or settling basin, and the purifying tank. The main drain from a house discharges all the sewage into the settling basin, from which an overflow is carried, allowing the fluids to pass over into the purifying tank. When this tank becomes two thirds filled, the fluids float a ball which opens a valve, allowing a disinfecting fluid contained in an iron reservoir, which may be located in the cellar of the house, to mix with the sewage while the tank is filling to the discharge level, thereby precipitating the putrescible matters contained in it. The discharge is by means of a siphon into absorption tile or adjacent watercourse. The tiles are laid close enough to the surface for the vegetation to absorb the nutriment that may yet remain; and thus an otherwise dangerous matter is converted into wholesome food for plants. The absorbent tile drains are protected from obstructions, while the intermittence of the discharge allows ample time for the earth to digest the previous supply, and become aerated. The solid matters may be thoroughly deodorized, drained, and solidified before removal, thus insuring cleanliness during the operation. The entire fluid contents are removed every day, or once in several days, according to the capacity of the tank, so that the sewage never attains that putrescence which long storage in a cesspool develops. The fluid contents are chemically treated before discharging into the earth, or watercourse, as the case may be, so that considerably less work is left to nature in purifying the discharges. The intervals between the discharges allow time for the absorption and assimilation of the fluids, so a supersaturation of the earth cannot occur. The tanks may be set close to the house, keeping as well up on the elevated part of the ground as possible, so that the discharge-pipe, when carried out level, will emerge close to the surface. The discharge-pipe and tiles are laid level, so as not to produce too much pressure when discharging. In case it is desired to discharge the fluid into an adjacent watercourse, instead of the ground, by the use of this tank it can be stored for three or more days, and the accumulated quantity discharged, when deodorized, in twenty or thirty minutes. This allows the intervening days for the thorough purification of the stream, and materially lessens, or wholly avoids, a very conspicuous nuisance, which is always present if the sewer is allowed to discharge continuously into a watercourse.

These few random notes will, I trust, be received in the spirit with which they are offered, and help to promote the object to be attained by a continual watchfulness of the drainage system of any house. Many of my clients have desired to do all in their power to make their homes healthful, but, finding it impracticable to have everything done at once, I have been forced to do the work by piecemeal, and in some cases directed work extending over a space of four years,—so that finally I could say, Your house is in a safe condition, for a season at least. But do not make the mistake of supposing that house drainage, however perfectly provided, will take care of itself when it is not in use. When once having been used, the condition is unavoidably such on suspension as to involve the liability of generating corroding and poisonous gases, destructive to the material of which the drain-pipes are made, and dangerous to health.

XVII.

COAST DEFENCES AGAINST ASIATIC CHOLERA.

REPORT OF AN INSPECTION OF THE QUARANTINES MAINTAINED UPON THE ATLANTIC AND GULF COASTS FROM THE ST. LAWRENCE TO THE RIO GRANDE.

BY JOHN H. RAUCH, M.D., SECRETARY ILLINOIS STATE BOARD OF HEATH.

At the July, 1885, meeting of the Illinois State Board of Health, the secretary was instructed by a resolution of the board "to inspect the methods of quarantine of the Louisiana State Board of Health and their actual operation at the stations below New Orleans; and also to extend his inspection of quarantine methods and regulations to such other ports and places as he may deem necessary in the interests of the public health of the state, with especial reference to the exclusion of Asiatic cholera and small-pox."

Such inspection was designed to supplement the action of the board,—inaugurated on receipt of the first information that Asiatic cholera had again invaded Europe, threatening another pandemic extension,—and which action aimed to secure the best attainable sanitary condition of the territory under its immediate jurisdiction as one of the most important preparations against the spread of the disease within the state, should the contagion be introduced.

The geographical position of Illinois,—within twenty-four to forty-eight hours of all the important ports on the Gulf and Atlantic coasts,—its commercial relations, the extent and character of its means of communication, and the fact that fully one half of the immigrants to this country come into or pass through the state, most of them remaining at least long enough to communicate contagion, and under conditions favorable to such communication, obviously make the administration of these quarantines—with especial reference at this time to the exclusion of Asiatic cholera—a matter of sufficient importance to warrant the board in securing all accessible information concerning them, the better to enable it to discharge its duty in connection with the protection of the lives and health of the citizens of the state.

In the present epoch of quarantine Illinois has a direct interest, chiefly commercial, in the exclusion of yellow fever from the Mississippi valley; in the exclusion of vaccinally-unprotected immigrants at the North Atlantic ports for the protection of her own territory from small-pox; and in the exclusion of Asiatic cholera generally, whether it threatens by

direct importation from Europe, or mediately through the West Indies, Mexico, and South America. In brief, the state is concerned in the condition of the sanitary coast defences, from the mouth of the St. Lawrence to the mouth of the Rio Grande.

PRESENT STATUS AND PROSPECTS.

It is hardly necessary to say that this country is not yet free from danger of an invasion of cholera simply because there is now a cessation of alarming reports from Europe. Periods of remission, more or less complete, have characterized every epidemic spread of cholera since it first invaded the latter country. Until it entirely disappears from the European continent it will not do for us to relax our vigilance or to remit a single precaution. On the contrary, this delay in its march should be utilized to strengthen our defences and to perfect our precautionary system. It must be remembered that the duration of a cholera invasion of Europe is not limited to two or three years. From the date of its first appearance in 1829-'30, in Russia, to its final extinguishment in Italy, Austria, and Germany, a period of seven years elapsed, during which, at one time or another, every one of the continental countries was invaded, some of them more than once. Similarly in 1847 it again entered Russia at two points, and before its final disappearance in the Levant in the winter of 1855–'56 it had traversed every part of the continent and invaded Great Britain. In its last pandemic spread it appeared first at Malta in 1865, continued to ravage various parts of Europe until 1869, when there was a complete remission, only to break out again in 1871, and finally disappear in 1873.

With immigrants from every portion of Europe continuously landing upon our shores and rapidly distributed throughout the interior, we shall not be freed from this menace until every trace of the contagion in that country has vanished. At the close of the year the disease still remained in southern Spain, in France at Brest, in Italy near Venice, whence it had spread to the Austrian port of Trieste, and it has also effected a landing on the Western hemisphere, in the French penal colony, Cayenne. Thus far the disease has not extended in Europe to the regions whence our heaviest foreign immigration is derived; and to this fact is probably largely due our present immunity. When the German and Scandinavian countries and the British Islands become infected, if they should, our serious danger will then begin.[1]

I am often asked, Do you expect to keep cholera out? To which my reply is, that it is the duty of every sanitary authority to try to do so; to strengthen the weak places, and perfect the strong; to utilize every possible resource; to secure the best attainable condition of his own immediate territory, and to put himself in a position to receive help from, or to extend help to, others in fighting and excluding a common foe. We may not be able entirely to shut it out, but it will be a great achievement

[1] Reports continue to appear in the public press of new outbreaks in Spain and elsewhere.

if its invasion be postponed and its spread limited, and greater still, if it is prevented a lodgment in this country. If an outbreak at a port or locality can be deferred until toward cold weather, that ally would itself help us to extinguish it, and it might require a fresh importation the next season to start another. It is our duty to try to shut it out, and not fold our hands supinely and join in the condemnation of quarantine and preventive methods, which in a great measure are a new outgrowth since the fever-summer of 1878, which have received a great stimulus to development by the present dread of cholera during the past two years, and which, so far as they have been tested in small-pox and yellow fever, give promise of success with the Asiatic pestilence. With a sufficient number of national refuge stations (there should be at least one on the Texas coast and one for New England, in addition to those on the Delaware bay, Hampton Roads, and Sapelo sound, and all of them should be as fully equipped as that at Ship island), with properly appointed quarantine establishments at the larger ports and inspection stations at the smaller ones, the entire system to be mutually coöperative, governed by the same general rules and regulations, kept fully informed of public health conditions abroad by consular agents and intelligent medical inspectors when necessary, there would be no reason to apprehend the introduction of cholera or any other foreign pestilence.

QUARANTINE IN THE PAST.

A brief summary of the origin and varying phases of quarantine in North America will be useful in this connection, mainly as serving to emphasize the distinction between the ancient and modern systems, and also for information.

From the date of the earliest establishment of quarantine in this country down to the present time, its efficiency and the public interest in it have been fitful and spasmodic, dependent upon some real or fancied pressing emergency. The ravages of imported small-pox led to the passage of the first quarantine laws in 1698, and these were added to from time to time, and either vigorously enforced or more or less neglected as that disease increased or declined with the conditions of immigration and the slave-trade. The plague, through Mediterranean commerce and outbreaks of yellow fever at long intervals, also affected quarantine laws and practice until near the close of the last century. For nearly thirty years, ending in 1791, the country was exempt from yellow fever, and during this period little attention was paid to the subject. That exemption, it may be noted, was due to the suspension of direct commerce with the West Indies through the enforcement of the colonial acts by Great Britain; but after the Declaration of Independence, commerce with the West Indies and the Spanish Main was gradually reestablished, and in 1791 began the yellow-fever epoch of quarantine following the increasing ravages of the pestilence in the principal seaports of the country, while small-pox gradually lost much of its importance

after the introduction of vaccination by Jenner in 1799. To yellow fever, after the war of 1812, and taking the place of small-pox as a quarantinable disease, there was added typhus or ship fever; and this disease—aggravated and often developed during the long voyages in sailing vessels, with crowded steerages and a gross neglect of hygienic observances—continued to increase in frequency and severity with the increase of immigration.

In 1832 Asiatic cholera was added to ship fever and yellow fever; and although this new plague has only affected quarantine by its four epidemic visitations, separated by long intervals throughout more than half a century, it marks another epoch in quarantine. Meanwhile the yellow fever zone in North America had become practically contracted to south of Philadelphia, once the most terribly scourged of American cities, and ship fever had lost much of its significance through the substitution of steamships for sailing vessels, and the enactment and enforcement, both by this country and by foreign countries, of laws for the prevention of overcrowding and for the protection of the health of immigrants. With the decline of ship fever, small-pox again began to increase in consequence of a neglect of vaccination, or its imperfect performance, and this disease again affected the public health more or less severely as the tide of immigration swelled or ebbed.

Within the past quarter of a century small-pox has more than once assumed epidemic proportions, as in the periods from 1868 to 1873 and from 1879 to 1883. Yellow fever has prevailed locally from time to time, and as an epidemic in the Mississippi valley in 1873, 1878, and 1879. Cholera spread throughout the country in 1866–'67, and invaded nineteen states west of the Alleghanies in 1873; and these three diseases, with their varying manifestations,—occasional long intermissions, followed by violent and disastrous epidemic outbreaks,—have dominated the quarantine question during this epoch.

In the few years immediately preceding this period some progress was made in an organized attempt to reform the abuses of quarantine, and to frame a system in accord with the increasing knowledge of epidemic diseases—one which should be freed from the unnecessary hardships and rigors of quarantines, revived or improvised in the face of existing danger, and too often inspired and enforced by an unreasoning dread and terror—similar to those witnessed in southern Europe during the past two years. This attempt was inaugurated by Dr. Wilson Jewell, of Philadelphia, one of the foremost sanitarians of his day, and who in 1856 proposed the establishment of "a uniform code of regulations, operating alike in all respects, and offering the least resistance to an active commerce, and with a humane regard for the health of the passengers and crews, and the comfort of the sick on board of all vessels detained at quarantine stations." A "Quarantine Sanitary Convention" was held in 1857 for the purpose indicated, and some progress was made during its subsequent sessions, when the outbreak of the Civil War put an end to the movement.

It may be here remarked, in passing, that these few quoted lines indicate the essential features of the quarantine of those days. They were primarily quarantines of detention or exclusion, inconsistent with an "active commerce;" the "health of the passengers and crews, and the comfort of the sick," were matters of secondary importance, and the enforcement of sanitary measures confined to proceedings of a most primitive character, where such measures were attempted at all. Little attention was paid to disinfection, purification, isolation of the sick, and the other measures which now receive most attention. The regulations entailed great personal sufferings and hardships, and vexatious delays and losses to travel and traffic, while they generally failed to protect the country from the introduction of these exotic diseases. It is not to be wondered at that "quarantine" has received so much condemnation.

COAST DEFENCES SHOULD BE UNDER NATIONAL CONTROL.

During all this time, from the earliest date to the present, the control of quarantine has remained entirely under the jurisdiction of state and local authorities, except during the brief period in which the National Board of Health exercised its limited quarantine powers under the act of 1878, and which expired in 1882. It is this absence of adequate national health authority and legislation, and the fact that in such absence the maritime quarantines are controlled and administered by state and local authorities—resulting in diverse and frequently conflicting regulations and requirements, and of necessity in a tendency to limit precautions to their own individual interests, commercial as well as sanitary—which throw upon interior states the responsibility of fully informing themselves of the strength or weakness of these outposts, in order to know where to anticipate danger, and how to make their own preparations to meet it.

At its last session, congress appointed a commission to examine and report upon the measures necessary for the defence of our sea-coast against a foreign armed enemy; and a distinguished publicist and statesman, Mr. Tilden, has recently urged this as a paramount duty of the government. Millions of dollars have already been expended for such defence, and millions more will probably be forthcoming to meet this possible contingency. But the assaults of foreign contagion are not a contingency. They are actual events, and during the past twenty years they have cost the country an aggregate loss of life only less than that of the great war immediately preceding. Every sanitarian and many of our leading statesmen know that this actual and ever recurring loss is wholly and entirely preventable by the expenditure of a sum which sinks into utter insignificance before the millions which will be appropriated for the protection of our coasts against a possible future danger.

But thus far neither sanitarian nor statesman has been able to overcome the petty jealousies of individuals, communities, and of states themselves, so as to secure the legislation necessary to remedy even the present confusion. Such sanitary measures as are now enforced by the national gov-

ernment are based upon authority derived from the act of April 29, 1878, to prevent the introduction of contagious or infectious diseases into the United States. But the late secretary of state, Mr. Frelinghuysen, and the late secretary of the treasury, Mr. Folger, both decided that the act in question, having been repealed by the act of June 2, 1879, could not be revived by the expiration of this latter act. The point would have less practical importance if the authority which assumes to act under it can and will furnish the country the necessary protection in the present emergency. Practical sanitary executives are less concerned, just now, as to who exercises the authority, and by what right, than in the questions, Is the authority wisely exercised? Is it sufficient? May we rely upon it implicitly? If not, to what extent, and how can we remedy its deficiencies?

It is by no means meant by this that it would not be better that there should be a properly organized national health department, acting under clear and undisputed legal authority, and supplied with funds adequate to its legitimate necessities. The present status of national sanitary legislation and of the national sanitary executive is admittedly defective and unsatisfactory. The history of the recent attempts to control the disinfection of rags; the complications at the port of New York concerning consular bills of health; the strictures upon the inspection service maintained along the coast, and in the matter of inspections on the Canadian frontier during the recent small-pox epidemic; the complaints of various boards of health that they are directed to look to the associated press for information and warning concerning threatened danger from abroad to their ports and territory;[1] and many other similar matters, point to the necessity for a well considered and radical revision of existing national sanitary legislation.

Consular bills of health, which are now, as a rule, almost worthless, might be made of the greatest value; and these, together with the prompt publication of direct and official information concerning the sanitary status of foreign ports—such information to be secured by competent persons—are essential to the prevention of the introduction of foreign contagion. Obviously such measures can be regulated, controlled, and provided only by the national government.

POSSIBILITIES OF PRESENT COAST DEFENCES.

Nevertheless, I am more than ever convinced, since completing this inspection, that Asiatic cholera, as well as small-pox and yellow fever,

[1] Both for the Illinois State Board of Health, as its secretary, and for the Sanitary Council of the Mississippi Valley, as its executive officer, I have attempted to secure such information, asking for copies of consular reports, or the essential facts contained therein as to the existence of epidemic contagious diseases at ports in commercial relation with this country, and with especial reference to Asiatic cholera; also for the addresses of medical inspectors stationed at foreign ports, etc. The secretary of state, in acknowledging the receipt of my requests, stated that they had been referred to the treasury department, informing me, in effect, that charge of all matters pertaining to the public health was assumed by that branch of the national government. No reply has yet been received from the treasury department nor from any of its bureaus.

may be effectually excluded from the United States by an intelligent use of the agencies still at our command. This is not a matter of speculation or theory. A great advance has been made since 1878. A quarantine of exclusion of these three diseases is now a matter of certainty, depending upon prompt notification of threatened danger; vigilant supervision over commercial intercourse with infected localities; inspection of all immigrants, and the enforcement of their vaccinal protection; sanitation and purification of infected vessels and cargoes; isolation of those sick with these diseases; the surveillance of suspects during the periods of incubation; and the employment of other well defined preventive and precautionary measures which now constitute the best modern sanitary practice as applied to maritime quarantine.

Cholera has never yet been kept out of this country after becoming epidemic in Europe, and I admit that quarantines, as conducted in that country, have proved ineffectual to control the spread of the disease. But the conditions which obtain here are radically different from those in Europe. In that country, as I have said elsewhere,[1] a narrow strait or sea, a river, a mountain chain, or merely a territorial boundary line, with its custom-houses and passport system, defines the limits to be guarded, and forms the only physical barrier between the quarantiner and the quarantined. Here, the whole width of the Atlantic intervenes between us and the infected country. There, cordons and quarantines mean privation, misery, suffering, and ultimately starvation. Here, the nation could exist unaffected in all her material interests by a quarantine whose period of detention is limited to the time necessary to destroy contagion through the rapid processes of modern disinfection and sanitation. There, it may be true, as alleged, that a quarantine of exclusion is impossible of execution, and that the attempt to maintain it does more harm than good, in leading to numberless contraband practices by which the disease may be introduced in unsuspected ways. None of this is true when applied to the exclusion of Asiatic cholera from this country; while to accept the statements unquestioned would cause vigilance to be relaxed, would invite contagion to our shores unimpeded, and would finally throw upon individual communities the burden and the responsibility of fighting the disease at an immense disadvantage, that is, of fighting it at home and from many quarters, instead of on the outer lines and from only one direction.

Those outer lines, even with some defects and weak places, I believe to be even now sufficiently strong to keep out the disease if proper vigilance and thoroughness be exercised, if all the facilities be utilized, and if timely notification of threatened danger be given by the national government.

The next year or two, however, will furnish a tolerably conclusive test of the efficiency of quarantine to exclude the pestilence from this country.

[1] "Practical Recommendations for the Exclusion and Prevention of Asiatic Cholera in North America." An Address delivered at the opening of the National Conference of State Boards of Health, St. Louis, Mo., October 13–15, 1884.

IMMEDIATE RESULTS OF THE INSPECTION.

During the progress of the inspection, it was observed that the comparisons instituted and the information furnished prompted quarantine officers and health authorities to avail themselves of facilities previously overlooked or neglected, and to put themselves in communication with each other for purposes of mutual coöperation and support. At many of the stations those in charge invited criticism and suggestions, while others would not rest satisfied until their facilities and appliances were made more complete. Suggested improvements have already been made in many instances, and others will doubtless be secured.

Not the least among the good results which are already perceptible is the recognition of the fact that the administration of quarantine at a given port is not a purely local measure; but that the country back of it, and communities distant in space but in close proximity in point of time, are also interested. Since states and communities continue to control maritime quarantine, and in many instances are jealous even of a suggestion of federal interference, it is right that they should recognize the full import of their obligations. Nor should they overlook the fact that these distant communities have the power both to help and to punish. Illinois, for example, by recently refusing entrance to immigrants coming through ports which were lax in enforcing vaccinal protection, furnished a powerful argument to the quarantine officers at such ports, whereby they secured compliance with their requirements by the steamship companies. This reflex action may be carried still further. If a port or locality should notoriously disregard the precautions necessary to prevent the access of cholera, it would be an obvious duty of self-protection not only to exclude immigrants, but to cut off all intercourse with such port or locality. With the danger of such a contingency clearly recognized, the authorities would not only be apt to exercise proper vigilance, but all transportation and commercial agencies—railroads and steamships—would become quarantine aids. Captains and officers would have an additional incentive for keeping their vessels in good sanitary condition, and for promptly reporting cases of suspicious sickness during the voyage, if it came to be understood that failure in these respects would be followed by loss of trade and employment.

One obvious advantage which may be expected to follow the publication of this report will be the notification to all interested of the weak places in our line of coast defences, and this will naturally ensure greater care and vigilance at such places and greater watchfulness of them by others.

To some places which I was unable, from want of time and pressure of other duties, personally to visit and inspect, the following series of questions was addressed, and subsequent correspondence elicited the necessary information in such cases:

1. What are the quarantine facilities at your port? Please furnish copy of laws or ordinances, and of rules and regulations.
2. How far from the city is the quarantine station?
3. Is the station out of the track of commerce or travel?
4. How far from the city are vessels inspected?
5. How are vessels, cargoes, and persons disinfected and purified?
6. What are the periods of detention, and the seasons?
7. How would a cholera infected vessel be treated?
8. Under what circumstances would vessels be sent to the nearest refuge station.

ATLANTIC AND GULF COAST QUARANTINES.

LOCATION OF STATIONS, EQUIPMENT, POWERS AND AUTHORITY, RULES AND REGULATIONS, METHODS, ETC., ETC., FROM CANADA TO TEXAS INCLUSIVE. ARRANGED GEOGRAPHICALLY.

CANADA.

On the 9th and 10th of October I made an inspection of the Grosse Isle quarantine establishment on the St. Lawrence river, about twenty-nine miles below Quebec. Dr. F. Montizambert, chief quarantine officer of the Dominion, telegraphed me on the 9th that he would send his yacht to meet me at St. Thomas, a station on the Inter-Colonial Railway, about thirty miles from Quebec. We left the wharf at this place about 4:30 P. M., but owing to head winds were unable to use the sails, and the men had a weary pull of two hours and a half to make the five miles to the station against the strong current and ebb tide. As this boat is the sole means which the station possesses for boarding a vessel for inspection purposes, I became quite convinced that a steam yacht or launch is a necessity in such a swift current and with such high tides as obtain in this stream, the channel being fully two and one half miles from the station. The Grosse Isle quarantine station is an island about one and one half mile long, divided into sick, central, and healthy divisions. In the sick division are the hospitals, with the necessary adjuncts. There is a two-story brick hospital with one hundred beds, including some in private wards for cabin passengers, ship's officers, etc., and a one-story wooden shed with about seventy beds. There are also ample facilities for disinfection, and for the purification of clothing, etc. In the central division are the quarantine officers' and chaplain's residences, and quarters for the employés, eight in number, embracing a hospital steward, a sergeant of police (who speaks four languages), a baker, and the boat's crew. From this point ships that stop opposite the station for inspection are gone out to. In the healthy division (a mile and a quarter from the hospital) are the houses of detention with accommodations for about two thousand persons, a large wash-house, a bakery, a furnace for hot-air disinfection, rooms specially arranged for fumigation, chapels, police barracks, etc. There is telephonic communication between the different divisions of the station, and telegraphic to Quebec. The disinfectants employed are chloride of lime, corrosive sublimate, and sulphurous-acid gas. Labarraque's solution is also used for the sponging and washing of patients and attendants, and permanganate of potass for coloring dangerous solutions. Chloride of lime in solution, four ounces to the gallon, is used in the vessels which receive the discharges of the sick. Infected clothing and bedding are steeped at once, in the wards, in a weaker solution of chloride of lime or of corrosive sublimate, and then boiled before being sent to the wash. The dry-heat oven is rarely used. What cannot be steeped for at least two hours, and then boiled for at least half an hour, is generally burned, in the absence of a steam disinfector. For fumigation, sulphurous-acid gas is used in closed apartments, either from burning the crude sulphur, or

from the copper reservoirs in which it has been stored under pressure, and which are obtained from New York.

Should a vessel arrive here with cholera, Dr. Montizambert purposes to treat her as follows: Land the sick and their attendants directly at the sick division, with everything suspected connected with them. Land all the steerage passengers and their effects, and place them in the detention houses at the healthy division. Open all wind-sails, hatches, port-holes, etc., on the vessel. Have the bilge-water repeatedly pumped out or changed. Supply unquestionable drinking-water to all. All the luggage of the cabin passengers and the effects of the crew to be opened out on board; all body and bed linen to be steeped in solution of corrosive sublimate; and other effects, with the opened trunks, etc., to be repeatedly fumigated with sulphurous-acid gas in closed apartments; the vessel in all attainable parts, and notably the cabins, steerage, and forecastle, to be scrubbed with solution of corrosive sublimate, and fumigated; the cargo to be opened up in as many places as possible, and then, the hatches, etc., being closed, the compressed sulphur dioxide to be poured in amongst it from the reservoirs. Should it seem necessary, the cargo would be landed to allow of its more detailed disinfection, and the more satisfactory treatment by washing, rinsing with corrosive sublimate solution, and fumigation of the empty vessel.

While the vessel and those on board are thus being attended to, the steerage passengers and their effects are washed and disinfected on shore at the healthy division. The attendants, being always amongst them, would report by telephone at once any slightest appearance of illness, and in addition a regular medical inspection is made twice daily of all those under detention, viz., at 9 A. M. and 4 P. M. each day. Any one showing even doubtful symptoms is at once removed from amongst the others, placed in a ward of observation, and thence returned to the healthy division, or taken to hospital, as may be required. Subsequent to completed process of disinfection, the vessel, passengers, and crew would be detained for eight clear days after the occurrence of the last cholera case before being admitted to pratique.

The process thus described is carried out with any vessel that arrives with an infectious disease diffused amongst its passengers, except that the vessel is allowed to proceed, after disinfection, without further detention. With a cholera ship, however, application would be made by telegraph for authority to detain the vessel and all on board, and it would probably be accorded.

Grosse Isle was for a long while one of the most important quarantine stations on this continent. Over fifteen thousand victims of cholera and ship fever are buried on the island. It was established during the sailing-vessel period, when—as the result of the long voyage, crowded steerage, and ignorance or disregard of all sanitary and hygienic observances—almost every arrival was more or less infected. For the requirements of the period, it was probably as well adapted and as completely equipped as any establishment in the world. The vessels then in use could easily approach its wharf, and receive such treatment as was at that time considered necessary.

But with the advent of the huge ocean steamships, with their great draught, short passages, improved accommodations, and imperative demand for "quick dispatch," the station has lost much of its importance. One set of conditions has largely obviated its necessity as a barrier against the introduction of epidemic contagion, while another set has created a necessity for improvements and modifications which have not been made. As a consequence, there is less attention paid to the maintenance of the station and to the enforcement of the regulations. During the season up to the 9th of October, the date of my inspection, only thirty-two vessels out of a total of four hundred and twenty arrivals had stopped at the station for examination.

My observations and study of the enactments suggest the following, as among the more important matters requiring attention, if this station is to be relied upon to prevent an invasion of cholera or other grave epidemic contagious disease *via* the St. Lawrence river,[1] having regard on the one hand to the efficiency of service, and on the other to the interests of commerce:

1. The boarding at Rimouski and inspection of the mail steamers is an absolute neces-

[1] Cholera was introduced into this country by this route in 1832.

sity, and all foreign vessels bound up should be inspected at or below Grosse Isle, so that if the vessel needs to be detained at quarantine the fact can be promptly ascertained, and if healthy, and free from danger of conveying infection or contagion, she may proceed without unnecessary delay.

2. The revision of the regulations, so as to secure the compulsory sending back to quarantine of any vessel that passes up to Quebec without having been inspected, no vessel to be allowed to enter the custom-house at Quebec or Montreal without first exhibiting the certificate of the inspecting medical officer.

3. Better facilities for boarding vessels at the quarantine station are required, as already suggested.

4. The adoption of some of the more modern appliances for disinfection, as, for example, a steam disinfector for rags, textile fabrics, etc., or the methods employed at the Mississippi quarantine of the Louisiana State Board of Health.

5. The vaccinal protection of the immigrants should be enforced.

6. The addition of another medical officer to the staff of the station.

7. Should it be impracticable thoroughly to disinfect a vessel or cargo, wharfage facilities, in addition to those existing at present, should be provided for vessels of the heaviest draft that navigate the St. Lawrence.

The modifications herein briefly indicated, with the facilities already possessed and the natural advantages fully utilized, would to a great extent remove the apprehension of cholera finding its way into the country through the St. Lawrence, and would materially obviate the necessity of restrictions over traffic and travel between the Dominion and the United States. Sweeping and onerous requirements, entailing unnecessary expense and delay,—especially if such expense and delay be due to inadequate equipment and appliances,—defeat the very object of quarantine, and provoke avoidable hostility and opposition, or lead to neglect and indifference. In order to make a quarantine effective as a safeguard of the public health, nothing should be required which is not clearly necessary. The facilities and regulations should be such as to insure a minimum of interference and inconvenience consistent with the end, and every necessary requirement should be rigidly, continuously, and impartially enforced.

The only diseases requiring attention at the present time are cholera and small-pox. Up to the time of my visit the vaccinal protection of immigrants was not enforced, and small-pox had repeatedly been introduced into Illinois and the North-west by unvaccinated immigrants coming through the Dominion. Since my inspection no unprotected immigrant is allowed to land, and under the present regulations the risk of imported small-pox contagion *via* the St. Lawrence is very materially reduced. A steam yacht has also been ordered to take the place of the yacht for boarding vessels at Grosse Isle. Upon this will be placed the modern appliances for disinfection above indicated.

During my inspection I was urged to make my criticisms and suggestions direct to the quarantine officer, and subsequently the Dominion government invited me to communicate the same to them.

In addition to the quarantine on the St. Lawrence there are two other quarantine stations maintained by the Dominion government,—one on Partridge island for the port of St. Johns, N. B., and one on Lawlor's island for the port of Halifax. These are subject to the same enactments as apply to the Dominion generally.

Dr. W. W. Wickwire, inspecting physician for the port of Halifax, writes me, under date November 20, " The quarantine station is on an island in the harbor of Halifax, about three and a half miles from the city. This island is owned by the Dominion government, and is used entirely as a quarantine station. The only persons living there permanently are the steward and his family. The island (Lawlor's) has an area of about one hundred and fifty acres. There are now hospital buildings affording accommodations for about one hundred persons, but additional buildings could easily and rapidly be constructed. The quarantine anchorage, where inspection takes place, is about three quarters of a mile from the city. Pilots are required to bring all vessels into this anchorage ground if there be any disease whatever on board, and there remain until inspected."

MAINE.

The navy department has been in the habit of sending yellow fever infected vessels to the navy-yard at Portsmouth, N. H., but, owing to protests by the citizens of that city against such action, Dr. F. M. Gunnell, surgeon-general, under authority of the secretary of the navy, in 1884, established a refuge station on Widow's island in Penobscot bay.

A temporary hospital and quarters for officers have been built, and an artesian well bored, from which an abundant supply of good water has been obtained at the depth of sixty feet. "The island is convenient of access from the sea, has excellent anchorage protected from storm winds, and affords a safe and desirable refuge for infected vessels coming north from the West Indies or Gulf of Mexico." The surgeon-general recommends, in his report bearing date October 1, 1885, that permanent buildings be erected at this place, and a strongly constructed wharf, to facilitate the landing of heavy stores from vessels, in order to accomplish thorough fumigation and disinfection. With the exception of this station there are no quarantine facilities along the coast of Maine, and this is under the control of the navy department. Why should it not be utilized as a refuge station, in case cholera is found on vessels in this neighborhood?

I visited Portland in August last, on account of the importance it possesses in this connection owing to its being the winter port of the Grand Trunk Railway, and thus receiving a considerable immigrant travel during the winter months. I found that inspections were made only upon the arrival of vessels at the wharf, when they are boarded by the city physician. If contagious disease, such as small-pox, be found on a vessel, it would be ordered to the quarantine grounds about two miles from the city. Those on board would be vaccinated, and such disinfection enforced as might be practicable under the circumstances.

The attention of the mayor, and subsequently of the state board of health, was called to the possibility of cholera being introduced by immigrants during the winter months.

NEW HAMPSHIRE.

Dr. Irving A. Watson, secretary of the New Hampshire State Board of Health, writes, under date of October 3, 1885,—"Except under unusual liability to infection, no quarantine is maintained at Portsmouth. The only vessels that come into the harbor of Portsmouth are coasters from American ports, and a few vessels now and then from the British provinces (New Brunswick and Nova Scotia). During the present month but one vessel has entered the port outside of coasters from American ports, and that was a vessel from New Brunswick, loaded with railroad ties. The very small amount of shipping that comes into Portsmouth outside of our own coast trade, which is very small, consists of now and then a vessel loaded with railroad ties from the provinces, and salt from Turk's island. There is no passenger traffic whatever. The quarantine laws of the state, as well as the city ordinances of Portsmouth, are quite strict, and in the very few instances of contagious diseases that have been found on board of vessels coming into the harbor of Portsmouth the masters of such vessels have notified the pilots, and a medical officer has been sent to them, and suitable quarantine established.

"Formerly there was a quarantine station about a mile down the harbor, which was established and used exclusively by the government. It now exists unoccupied. There has been no occasion for the disinfection of cargoes for many years, I think. The government has sent one or two vessels, among which was the Plymouth, up to this port to freeze out the yellow fever.

"I do not know of a single instance in which disinfection of vessels, crews, and cargoes has been required. I have recently investigated the condition of affairs at this port, and do not find it necessary at the present time to establish a quarantine station. There is not the least probability of small-pox being brought to Portsmouth from Montreal and vicinity, or from the provinces, by water. On the other hand, we have no infected cities to fear along our own coast, and, as no vessels arrive from foreign ports, other than those mentioned above, there seems to be no demand whatever for a quarantine service. Should any circumstance arise that would make it necessary to establish such a service at Portsmouth, we would do so."

MASSACHUSETTS.

In company with Dr. S. H. Durgin, chairman, and Mr. George F. Babbitt, a member of the Boston board of health, I made a visit of inspection to the Boston quarantine establishment, on the 13th of August last. This is situated on Galloupe's island, about seven miles from the city, and comprises abundant hospital accommodations for contagious diseases in two buildings, a large store-house for infected cargoes, connected with deep water by a suitable wharf and tramways, and upon another wharf is a building for disinfecting clothing, baggage, etc. The island is about twelve acres in extent, and vessels may lie at its wharves entirely out of the track of commerce. The arrangement of the buildings, etc., is compact and workmanlike, and everything was found in good order.

The boarding station is at Deer island, about a mile and a half from quarantine, and the port physician resides at this station during the entire year. The quarantine steamer, Samuel Little, is also kept at the Deer island station ready for boarding vessels, conveying the sick from vessels to the hospitals, etc. Since my inspection this vessel, built for the quarantine service thirteen years ago, has been ordered to be replaced by a new one with important improvements and better facilities for disinfection. The regulations require the port physician in quarantine to visit and inspect all vessels arriving in the harbor between June and November from any foreign port, except Canada and the provinces, and from any domestic port south of Virginia. No vessel which has had on board during her last voyage any sickness of a contagious or doubtful character, shall pass quarantine without inspection and consent of the port physician. It is also provided by regulation that no vessel shall be allowed to bring any sickness of a doubtful or contagious character past quarantine during any season of the year. Every facility is provided for the speedy and comfortable transfer and the subsequent care of such persons as may arrive by vessels suffering from contagious or infectious diseases. The *personnel* of the quarantine establishment consists of two physicians and the necessary employés. The physicians are employed during the whole year. When quarantine duties do not demand their attention, they are occupied in the city institutions on Deer island.

In the large store-house there is an apartment for disinfecting rags and other articles by the sulphurous-acid process, and there is also a large amount of storage capacity. The disinfection of clothing, personal baggage, etc., is effected by the steam process. The superheated steam is supplied by the quarantine steamer. For my observation the steam was discharged into the apartment provided for this purpose, and in a few minutes the temperature was raised to 220° F., at which point it was evident it could be maintained as long as desired.

All immigrants are examined on arrival, and are vaccinated or revaccinated, if not protected by decidedly recent vaccination or revaccination. Careful scrutiny is bestowed on all persons and goods arriving by vessel, and such cargoes, vessels, and personal baggage as seem to require it are thoroughly disinfected, as above indicated.

The administration of quarantine at Boston has received for the last nineteen years the direct supervision of the present chairman of the city board of health, and the access of cholera through this port is hardly likely to occur. During this period I have been able to trace small-pox cases to Boston very rarely, and none for several years recently. The methods pursued at this port demonstrate that the disease may be excluded.

RHODE ISLAND.

The quarantine regulations of the port of Providence are under control of the board of aldermen, who appoint annually a health officer of quarantine to execute such orders as said board may from time to time prescribe relating to quarantine. Dr. Charles V. Chapin, superintendent of the health department of Providence, writes "that all vessels subject to quarantine are stopped about one mile below the city. Vessels are inspected by the health officer before they are allowed to come to the wharf, or have any communication with the shore.

"Our foreign commerce is very small, mostly with St. John, N. B., and with the West Indies. The only European arrivals we have are a few Italian vessels with sulphur.

"If any vessel was found to be infected, I would have her thoroughly cleansed and dis-

infected with sulphur or chlorine, or both. Baggage and clothing of crew could be treated on shore at the small-pox hospital grounds, which are situated near quarantine. Our channel is so narrow that it is impossible for vessels to anchor very far from the line of travel."

CONNECTICUT.

The quarantine facilities of New Haven, the most important Connecticut port, are described by Dr. Lindsley, secretary of the state board of health, as "not entirely satisfactory. No special preparation exists for the proper management of vessels subject to quarantine, excepting that the board of health of New Haven is clothed with full authority to subject any such vessel to such regulations for the protection of New Haven as said board may deem necessary.

"The vessel (and cargo, if necessary) would be disinfected by the fumes of burning sulphur and subsequent ventilation, and washing with solution of corrosive sublimate or some of the preparations of chlorine. The clothing of the crew and their personal effects would be also disinfected, and they would be kept under supervision until danger of communication of the disease had passed.

"Vessels on which there has been no malignant or contagious disease during the voyage, and on which there is at present no sickness, may come to any public wharf in New Haven harbor, and signal for the health officer; but no person is allowed to leave the vessel before the arrival of the health officer. In case of any sickness on board, the vessel shall come to anchor within quarantine limits, and signal for the health officer from there. The quarantine station, as you will see by the enclosed map, is only one and one half mile from the centre of the city, and in New Haven harbor directly in the line of travel. In case of the arrival of a cholera vessel, it would be detained in quarantine. There is no hospital provided for the reception of cholera. The patient would be kept on board under such care as was practicable, respecting isolation and disinfection, until a temporary provision could be made (by tents probably) on the shore for his or their reception, after which the vessel would be disinfected. If the cargo was such as to require special apparatus for disinfecting it, we have none, and should have to send the vessel to New York or elsewhere for that purpose."

NEW YORK.

About two thirds of the total immigration, and more than two thirds of the total foreign imports into the United States, pass through quarantine at the port of New York. Without assuming that these proportions may be taken as a measure of the relative importance of the New York quarantine compared with the quarantines of the rest of the country, its absolute importance cannot be overestimated. The individuals and their effects, and the cargoes with which it deals, are distributed to every part of the continent, and while from climatic and other conditions the port itself might be protected by given quarantine methods, it would by no means follow that measures adequate for such protection would ensure the safety of remote sections of the country from the disastrous effects of the importation of foreign contagion or infection through and beyond the port. Many improvements in the New York quarantine system have been made during the past twelve or fifteen years, and to a great extent in direct recognition of these considerations. During this period the interest of the interior in the administration of the system has come to be acknowledged, and is allowed to exert some influence.

The statutes relating to quarantine of the port of New York are very voluminous, but the most important are to be found in chapter 358 of the Laws of 1863, entitled "An act establishing a quarantine, and defining the qualifications, duties, and powers of the health officer for the harbor and port of New York," and in chapter 592 of the Laws of 1865, amendatory thereof. Although there is a board of quarantine commissioners consisting of three members, the powers and duties prescribed by the law are practically exerted and discharged by the health officer aforesaid. In 1880, upon the establishment of a state board of health, this officer, together with the attorney-general and the superintendent of the state survey, were made *ex-officio* members of the state board, but no control or authority over maritime quarantine is conferred upon or exercised by the board, except indirectly through the *ex-officio* connection of the health officer, who is chairman of a standing committee of that body upon the subject of quarantine.

On the 10th, 11th, and 12th of August, in company with Dr. William M. Smith, health officer of the port, I made a personal inspection of the quarantine establishment, and of the methods enforced thereat. The quarantine anchorage is in the lower bay, a triangular area of about two and one half miles along its sides, its northern apex being about eleven miles from the city and five miles from the health officer's station, near Clifton, on the left shore of "the Narrows." At the upper apex of the anchorage, and about four miles inside of Sandy Hook, is moored the quarantine ship "Illinois," in charge of a deputy inspector.

After the first day of May, and until the first of the ensuing November, all vessels from the West Indies, the Windward Isles, the east coast of South America, and the west coast of Africa, as also those from infected ports of the United States, are brought to an anchor near this vessel, and boarded by an inspector from an ordinary row-boat. The officer ascertains,—1st, the present condition of the passengers and crew; 2d, the history of the vessel during the passage in reference to sickness, etc., and the sanitary history of the vessel while in the port of departure. The bill of health is then examined, and the sworn statement of the captain and medical officer of the vessel is next required, each being duly sworn, that the port or ports from which they sailed were, to the best of their knowledge and belief, perfectly healthy, being free from all malignant, contagious, and infectious disease; that no such disease existed among the shipping in said port or ports at the time of their departure; and that no case of sickness or death from small-pox, cholera, yellow fever, ship fever, or any other contagious or infectious disease, has occurred on board their vessel while in any port or on the passage.

A careful examination is made in every instance of the steerage, and if objectionable from filth it is ordered to be immediately cleansed and then fumigated. If the vessel has been absent from the port of departure for a time equal to or exceeding the usual period of incubation of the disease prevailing at such port, the passengers are inspected by the quarantine officer, and the vessel is discharged under a permit.

If there is any sickness of a suspicious character resembling yellow fever, cholera, or typhus, the sick are removed to the quarantine hospital on Dix island. If the ship is less than five days from a port infected with yellow fever, passengers and vessel are held until that period has fully elapsed. In the meantime the hatches are opened, the cargo and steerage are fumigated twice, at various intervals of several hours, with chlorine or sulphurous-acid gas.

All baggage, mails, and whatever articles liable to have become infected, are put in a close apartment, and submitted to disinfection by the agents mentioned. This done, the master of the vessel is given a "permit," and directed to the discharging anchorage in the upper bay, distant three miles from the city. Here (in the language of Dr. Smith's report), under the constant supervision of the quarantine police, and the frequent visitation of the health officer, the most perfect system of cleanliness is enforced. In the meantime the cargo is discharged upon open lighters. The exposure of the cargo to air in its transit to the dock serves still further to remove the danger of infection. There is no instance of the propagation of disease from that source in the history of quarantine at the port of New York. The cargo being removed, the hold is thoroughly washed; and in the case of sailing vessels the limber-streaks along the keelson are taken up, accumulations of filth removed, and the air-spaces washed down, until the water returns clear of any evidence of impurity. A solution of sulphate of iron, or of bichloride of mercury, is then used, with which to scrub and rinse the entire hold, inclusive of the air-spaces and limber-streaks. Finally, from fifty to one hundred pounds of sulphur, according to the size of the vessel, are burned under the hatches, which are closely covered. The ship's crew is then mustered, and examined as they pass before the health officer. If all are well, the vessel is allowed to proceed to her dock without further delay. In vessels suspected of yellow fever infection the crew are not allowed to discharge cargo, or if they do are submitted to a quarantine of observation for five or six days.

All foreign vessels not subject to visitation in the lower bay are boarded by the health officer or his deputy at the boarding station on Staten Island, a short distance above the Narrows, and opposite the health officer's residence. From May until November following all vessels from ports "south of Cape Henlopen" are visited at this point, unless

some of the ports south of this become infected with yellow fever, in which case vessels from such ports are examined at the quarantine station in the lower bay.

The quarantine hospital for yellow fever and other contagious diseases, except small-pox, is upon Dix island, an artificial construction about two miles above the quarantine anchorage towards the Staten Island shore, out of the track of commerce. The hospital is built on the pavilion plan, has five wards connected by covered passage-ways, and has comfortable accommodations for 300 patients. There are also on the island suitable quarters for officers and attendants, a disinfecting room, and all the modern sanitary appliances. Small-pox cases are not treated here, but are taken to one of the city institutions on Blackwell's island in the East river.

One mile above Dix island is Hoffman island, also artificial, and upon this are the buildings and appliances necessary for a quarantine of observation. "Suspects" from yellow fever, cholera, typhus, or yellow fever exposure, are here detained during the respective periods of incubation. Two immense structures furnish accommodations for about 2,000 persons, and in another building are the quarters for officers and employés, and for administration purposes. Abundant bathing and laundry facilities and disinfecting appliances are provided, and here, as well as on Dix island, are immense reservoirs and a number of cisterns for the storage of fresh water.

The health officer's station, or main quarantine station, is near Clifton, and at this place is the residence of the health officer, quarters for two deputies, and a good wharf. Vessels are here boarded from a commodious steam yacht, by which, also, communication with the other divisions of the quarantine establishment is maintained. The islands and stations are connected by telegraph, and the health officer's quarters are also connected by wire with the city.

The *personnel* of the establishment varies with the exigencies of the season. In addition to the health officer, I found only two deputies employed, one upon the quarantine ship and one at the quarantine station. Dr. Smith himself attends to the sick in hospital, and was treating a yellow fever case (convalescent) during my visit.

Summing up, with reference to the exclusion of cholera and small-pox,[1] the quarantine plant and facilities of the port of New York are unrivalled, the printed regulations judicious, and with proper vigilance the service should suffice to prevent either of these diseases from obtaining access to the country through this avenue. But the entire system is hampered by a vicious financial policy, which is, in effect, a farming-out of the service. At the other important ports the fees go directly to the municipality or state, and the chief executive officers are paid fixed salaries, and are provided with such employés as may be necessary to the proper and efficient conduct of the quarantine.

New York may exclude cholera under her present system, but more confidence would be reposed in the result if less were demanded of professional ability, personal integrity, and executive firmness in the health officer, and if the system were freed from influences which are most deprecated by those who without prejudice best understand them.

PENNSYLVANIA.

The maritime quarantine of the port of Philadelphia, and practically of the state of Pennsylvania, is enforced at the "Lazaretto," situated on the left bank of the Delaware river, about eleven miles below Philadelphia. In company with Dr. R. A. Cleemann, of the city board of health, and Dr. Benjamin Lee, secretary of the state board of health, I made a visit of inspection to this station on the 6th of August last. The quarantine grounds are about ten acres in extent, surrounded by cultivated farms, and separated from the main channel by Little Tinicum island, between which island and the station there was formerly a navigable channel which was used as the quarantine anchorage, but is now too shallow for that purpose for large vessels. Quarantine was established at this point in the early part of the century, and sections of a law enacted in 1802 are still in

[1]Cholera found its way through this port to the eastern portion of this country in 1849, and to the country generally in 1865. No attention is paid to the vaccinal status of immigrants unless the disease is actually on vessels. As a natural consequence, small-pox has repeatedly been introduced into the interior through this port.

force. There has been practically little change in the equipments or methods since 1818, except that a steamboat has replaced the many-oared barge used formerly in visiting, and that by this means vessels are inspected *en route*, not being obliged to come to anchor unless detention for sickness is necessary. The structures, comprising a large hospital (sixty beds), administration building, government warehouses, etc., are well built and spacious, but antiquated. For more than half a century the establishment was the best equipped on the continent. All vessels from foreign ports, and such American ports as may be designated by the board of health of Philadelphia, bound for the port of Philadelphia, and arriving between the first of June and the first of October, are required to come to anchor as near the Lazaretto as the draft of water will permit, and there await the visit of the quarantine officers,—the Lazaretto physician and the quarantine master. The former administers the oath or affirmation to the captain, and examines personally into the state of health of all on board, and, in conjunction with the quarantine master, ascertains the sanitary history of the voyage, condition of port of departure, character of cargo, etc. The latter officer examines into the condition, with regard to cleanliness, of the hold, cabin, and forecastle, causes the bilge to be pumped out and purified by fresh water, and ascertains whether any part of the cargo is in a damaged or infectious condition. If the vessel is satisfactory in all these respects, a certificate to that effect, signed by both officers, is furnished, and she is allowed to proceed to the port. This certificate is addressed to the health officer of the port, to whom it must be delivered within twenty-four hours after the vessel lands at her wharf.

If any contagious or infectious disease (measles excepted) be found on board, or if the vessel be from an infected port, or if her cargo be considered dangerous as to contagion or infection, or the vessel's sanitary condition be unsatisfactory, the certificate is withheld, and the necessary measures are instituted to render her safe from conveying contagion or infection. These measures are entirely within the discretion of the Lazaretto physician[1] (of course under the control of the board of health of the city), and are enforced under his supervision by the quarantine master. So far as they are prescribed, they consist of purification "by ventilation, scrubbing, and whitewashing." Fumigation is effected by sulphur combustion in iron pots. There are none of the modern appliances for disinfection of vessels or cargo. No attention is paid to the vaccinal status of immigrants, unless small-pox is discovered on a vessel; and as a natural consequence the disease has frequently been introduced into the interior through this port. Telegraphic communication has recently been established with Philadelphia.

Owing to the filling up of the channel in front of the Lazaretto, large vessels detained in quarantine could not be kept out of the track of commerce as completely as is desirable. In examining the surroundings of the station, we proceeded on the quarantine steamer as far south as Chester, at which place we found the revenue cutter from which inspections of vessels arriving in the Delaware bay are made. In connection with these inspections I took occasion to repeat the suggestion made at Baltimore, to wit, that the government inspection service should be utilized as fully as possible, and to this end should receive the coöperation and recognition, not only of Pennsylvania, but of the Delaware and New Jersey health authorities, state and local. This suggestion was subsequently acted upon by the adoption of a resolution by the Philadelphia board of health, requiring all vessels from infected ports to report for the removal of sick sailors at the U. S. quarantine station at the Delaware breakwater before proceeding up the river.

Dr. Benjamin Lee, of the state board of health, wrote me on the 28th of September, that "in company with Drs. Cleemann and Ford, and several non-professional members of the city board, Dr. Wilson, the Lazaretto physician, and Dr. Bailhache, of the Marine Hospital Service and National Board of Health, I visited the U. S. quarantine station at the Delaware breakwater on September 4. Dr. Marshall, of the Delaware state board, joined us on the way. Dr. Hunt, of the New Jersey board, fully expected to come, but was prevented by an outbreak of typhoid somewhere in his bailiwick." After describing the accommodations, surroundings, etc., and means of boarding vessels, Dr. Lee adds,—"The vessels lie about four miles off in very rough water, and decline to come inside the

[1]Appointed by the governor.

breakwater on account of the time which it takes. The only boat is a little yawl, entirely unfit for heavy weather. There is space enough to put up temporary barracks here in case of emergency, and there is a government pier close by, to which vessels could be brought. There are no arrangements for disinfecting cargoes or clothing.

"It is doubtful whether this would be the best place for a permanent quarantine station, on account of the exposed situation and roughness of the water; also because, in case of storm, so many vessels take refuge here, often close together. The distance from the city is also a possible objection. [?] I think there must be an island higher up the bay somewhere, which could be utilized for the purpose."

DELAWARE.

Quarantine along the Delaware coast is limited to the local regulations of the coasting trade. There is a government quarantine station at the Delaware breakwater, described in connection with the Pennsylvania quarantine system.

MARYLAND.

On the 4th of August, accompanied by Dr. James A. Steuart, health commissioner, I made an inspection of the quarantine establishment at the port of Baltimore. This is situated at Little Hawkins, or Leading Point, about seven miles from the city, on the Patapsco river. The grounds belonging to the station embrace about twenty-five acres, surrounded by improved farms. There is a new and well arranged hospital building, with accommodations for forty patients, also a residence for the physician in charge, boatmen's house, stables, etc., all in good condition, and neatly kept. The station is connected by telephone with the city. There is no provision for the care of those detained for observation after exposure upon an infected vessel. The hospital facilities may be increased by the use of tents in suitable weather, and in case of emergency, the old quarantine establishment now used as a small-pox hospital might be utilized.

The quarantine season extends from May 1 to October 31, and during this period an assistant resident physician is on duty at the station. All foreign vessels bringing passengers are required to stop for examination throughout the year. No attention is paid to the vaccinal protection of immigrants unless small-pox is discovered on a vessel, and, owing to this neglect, repeated introductions of the disease into the interior have occurred through this port. Vessels are boarded in the harbor from a steam tug, kept in constant readiness for that purpose. The depth of water at the quarantine anchorage is about twenty-two feet at low tide, and there is plenty of room to anchor vessels out of the track of commerce. There are no facilities as yet provided for the discharge and disinfection of cargo from an infected vessel, but additional facilities and proper appliances for disinfection are contemplated.

As a further precaution in the present emergency, I suggested the advisability of requiring vessels to submit to inspection by the government service at Cape Charles.

VIRGINIA.

Dr. James D. Galt, the quarantine medical officer of the Elizabeth River district, has furnished the following from Norfolk, under date October 20, 1885:

"In reply to your inquiries as made in letter No. 20,519, I would briefly state that the quarantine facilities of this port are ample. Situated on the Elizabeth river, itself an estuary of Hampton Roads, there is all the sea-room necessary for an efficient quarantine. The quarantine station is abreast of Carey island, five miles below the city, where the river rapidly widens into Hampton Roads. Vessels are invariably examined at the station, and are absolutely prohibited from coming up until inspected by the quarantine officers.

"There is nothing special about our method of disinfecting vessels, cargoes, and the crew. The fumes of burning sulphur are usually employed. Sometimes, in the case of large-sized vessels, chlorine, generated by the action of sulphuric acid upon common salt, is also employed below the water-line. Vessels in quarantine are anchored at a safe distance outside the main ship channel.

"So far I have had no cholera infected vessels to inspect. Should any such arrive, I would treat them on the same general principles of disinfection as other vessels, giving special attention to the thorough disinfection, or destruction, if necessary, of all clothing bedding, rags, or any other materials which might act as fomites for the infection."

In response to a subsequent inquiry, asking what assistance or protection has been afforded by the quarantine or inspection maintained by the national government, through the marine hospital and revenue marine services, Dr. Galt writes, that "while it does not relieve me from responsibility as the local quarantine officer, it is undoubtedly an additional protection to this city, and I would compare it in military phrase to a second line of entrenchments around us. This service is, as you know, maintained only during the warmer months, and was raised on the 10th inst. [Nov.] for the winter, so that I am now without its assistance."

Subsequently, Dec. 31, the following information was furnished through Dr. Galt by Dr. F. M. Urquahart, of the marine hospital service: "The service has two quarantine steamers, the Woodworth and Manhattan, which are used for inspecting vessels. If any vessel is found infected it is carried to Fisherman's island and quarantined, and the sick placed in hospital on the island. The hospital was built during the summer of 1884, and contains about twenty beds.

"Fisherman's island is just off Cape Charles. A keeper and assistant remain at the hospital at all times, and extra help is employed in case of sickness. Two surgeons of the marine hospital service are detailed for the summer season (May to December), the one in charge, the other as assistant. The vessels inspected are all foreign vessels and vessels from the southern ports of the United States. Every vessel is thoroughly inspected (each man inspected and cargo examined). If vessel is found infected, cargo is transferred to lighters and thoroughly disinfected (or thrown overboard), and vessel thoroughly cleansed, disinfected, and detained in quarantine for a certain length of time."

NORTH CAROLINA.

There are four ports of entry on the North Carolina coast, all having good and spacious harbors, namely, Edenton, Beaufort, Newberne, and Wilmington. Of these the port of Wilmington is the only one of importance for quarantine purposes. Dr. Thomas F. Wood, secretary of the North Carolina State Board of Health, writes as follows concerning quarantine at this port:

"In reply to your letter of inquiry No. 20,513, I would say,—Our quarantine facilities are inadequate. The quarantine station is at the mouth of Cape Fear river, twenty miles from Wilmington. At this station certain vessels are required to proceed at once to the station for inspection. The quarantine officer is appointed by the governor. He lives at the station, and has immediate charge of all the details of disinfection, cleansing, unloading, and police direction of the detenues.

"In all cases of doubt he submits his case to the advisory quarantine board, two gentlemen selected by the president of the state board of health, who reside in Wilmington. Each vessel is treated upon its individual merits, and the rules are made elastic enough to apply to each case.

"Our means of disinfection are primitive. The vessel is unloaded, bilge is pumped out and fresh water pumped in until it is discharged clear and odorless, and the disinfection is completed by burning sulphur under closed hatches. The vessels are unusually small, and come in ballast, and as they are not numerous there is little difficulty in performing satisfactory cleansing. When there is doubt, the vessel is required to load at the station, the cargo being carried to it in lighters.

"Should a vessel put in with cholera on board, we would relieve the necessities and have her towed to Sapelo station. If her crew was small, we would keep her under observation, and treat the men on board. The quarantine hospital was burned two years ago, and the state has not rebuilt it."

Dr. Wood encloses a printed copy of the quarantine regulations, but as these are sufficiently summarized in his letter they are omitted from this report.

SOUTH CAROLINA.

The quarantine system of South Carolina is governed by the provisions of a state law, approved December 20, 1881, entitled "An act to render more efficient the quarantine service of the several ports of the state." Under this enactment the administration of quarantine at the port of Charleston is placed in charge of the board of health of the city, subject to the advice and supervision of the executive committee of the state board of health. At the other ports of the state, quarantine remains under the supervision and control of this latter body, and the stations at Georgetown on South island, at St. Helena entrance on Buzzard's island, and at Port Royal on Paris island, have received special attention since the danger of cholera importation became imminent. Many of the buildings have been repaired, and new ones have been erected on the site purchased last year on Buzzard's island.

The following regulations—which are uniform with those in force at the Georgia quarantine stations, so far as relates to foreign vessels—govern the quarantines of South Carolina:

I. On and after the opening each year of the national quarantine station (Sapelo sound), all vessels from infected or suspected latitudes, arriving with sickness on board or having had same during voyage, must be directed by the pilot to proceed to said national quarantine station.

II. Any vessel arriving at this port bearing the certificate of the national quarantine officer, must be brought to anchor at the quarantine station, and there remain until released by the order of the board of health.

III. During the closure of said national quarantine station, all vessels such as above described must anchor at the port quarantine station, under personal direction of the quarantine officer.

IV. Vessels from any foreign port direct, or *via* American ports, with or without sickness on board, will, during the entire year, be compelled to anchor and remain at the quarantine station until released by written permit of the quarantine officer.

V. All vessels arriving at this port with sickness on board, or having had same during voyage, will, at all seasons of the year, no matter from what port, either American or foreign, anchor at the quarantine station, and there remain until released by order of the board of health.

VI. Vessels from infected or suspected latitudes will, during the entire year, be required to discharge any and all ballast at the quarantine station, or such other place as may be designated by the health authorities, in the harbor under water; to have bilges and limbers cleaned and sweetened, and from May 1st to November 1st of each year be subjected to at least two fumigations and such other disinfection as may be necessary, and be detained at least fifteen days.

VII. On and after May 1st, and until November 1st of each year, and longer if the board of health so determine, all coastwise vessels or steamers from latitudes south of Cape Hatteras, other than those by inland route, must anchor at the quarantine station. Steamers and vessels from non-infected or non-suspected ports will not be detained longer than necessary for the quarantine officer to satisfy himself of their perfect sanitary condition. Vessels from infected or suspected latitudes will have to comply with section VI, be fumigated at least twice and detained at least fifteen days.

VIII. Coastwise steamers and vessels arriving at this port by inland route, from latitudes south of Cape Hatteras, between May 1st and November 1st, and later, if the board of health so determine, must be inspected and given permit by the quarantine officer, before the landing of either passengers or freight.

IX. From May 1st to November 1st of each year no vessel from an infected or suspected latitude will be allowed to either lighter or bring cargo of fruit up to the city.

X. Pilots must, in each case, before boarding, make inquiry as to the sanitary condition of vessels. In no case must they board if the vessel has sickness on board, or has had same during voyage. In such cases they must either direct to Sapelo quarantine station, lead the vessel in, or have their small boat hoisted alongside, clear of the water, and in this way pilot the vessel in.

Dr. H. B. Horlbeck, city registrar, and secretary of the Charleston board of health, furnishes the following information concerning the station at the port of Charleston:

The station at Fort Johnson, on James island, is about two miles east from Charleston in the harbor. The buildings comprise a fever-hospital and pest-house, offices, etc. There is a fine and commodious wharf, also boats for boarding purposes, under care of a quarantine officer, and a guard boat. Service is maintained from May 1st to November 1st every year, to prevent unauthorized communication with the station. This service is also continued from November to May when necessary. Vessels are inspected at the station in the stream. They are fumigated with sulphurous-acid gas, and disinfected with the bichloride of mercury solution. Cargoes of fruit from infected ports are not permitted to go to the city from May 1st to November 1st, and certainly no other cargo until it has been taken out of the ship at the station and fumigated (see quarantine regulations). Vessels arriving pass within a few hundred yards of vessels detained at quarantine. No vessel from a cholera port is allowed to come in, but is ordered to Sapelo. Should a vessel have either cholera or yellow fever break out at quarantine, it would be sent to Sapelo instanter, or on the next tide,—that is, certainly within twelve hours."

GEORGIA.

Dr. J. T. McFarland, health officer of Savannah, furnishes the following in response to my letter:

"The quarantine station is located seaward of the city, distant between fourteen and fifteen miles, upon an oyster-bed shoal. This shoal is entirely surrounded by water, and is covered about four feet in every flood tide. One short angle of the river channel runs within about three hundred yards of the station. All vessels from infected or suspected ports and latitudes are required to discharge ballast all the year round at this quarantine station. No ballast from the West Indies, or suspected localities north of Rio de Janeiro, has been allowed to be brought to the city of Savannah since 1876. This regulation was instituted as a guard against yellow fever introduction.

"The facilities of the station are not as great as are required: an increase of wharfage and the erection of a storehouse are needed.

"All vessels are inspected at the quarantine station by the resident physician. Vessels in cargo, from foreign ports, seldom come to this port between May 1 and November 1. I believe this is the case at the other South Atlantic ports. During this season but one vessel in cargo (guano) has arrived here. Coffee vessels have been in the habit of coming to this port, and have been required to undergo sulphur fumigation with cargo in place: the fumes of the gas do not injure the quality of the bean in the slightest degree. The cargo is then allowed to be taken by lighters to the city, while the vessel is detained at the station; her bilges and timbers are cleansed and disinfected with solution of sulphate of iron or bichloride of mercury, and, along with all clothing and bedding, she is then subjected to a second fumigation. The requirements having been carried out, and no sickness having occurred on board during detention time, permit is granted by the health officer for vessel to come to the city. The clothing on board any such vessel is subjected daily, during detention, to the action of fresh air, all bedding and clothing being exposed on deck of vessel, and in some cases these are subjected to boiling. Fumigation with chlorine gas is frequently resorted to—always when there is any suspicion of small-pox infection.

"So soon as cholera became epidemic in Spain this past summer, orders were issued to the pilots of this port not to board, but to direct to the Sapelo quarantine station any and all vessels arriving from ports infected with cholera. This national quarantine station is distant only about sixty miles from the mouth of the Savannah river. Recently orders have been issued allowing pilots to lead to the port quarantine station any vessel from the Mediterranean coast, when such vessel has not had death or acknowledged infectious disease aboard during her voyage. This change of order was made in consequence of the decrease of cholera in Europe. These vessels were ordered to the national quarantine station because they were all deemed entitled to thorough cleansing, and the health authorities of Savannah decided that if cholera did make its appearance on board any of them while having the clothing, bedding, etc., attended to, it would be decidedly prefera-

ble to have them away from this port. Vessels arriving at this port from yellow fever latitudes are not boarded by the pilots. Such vessels are led into quarantine grounds if they have not had sickness on board during voyage. If they have had sickness on board during voyage, which the captain acknowledges to have been suspicious, he is directed to the Sapelo station. If any vessel arrives at the port quarantine station, and it is determined after investigation that she has had infectious or contagious disease on board, she is immediately ordered to leave the port, and is directed to the national quarantine station. This refuge is unquestionably a very great safeguard and help to this portion of the Atlantic coast, and in helping and protecting us it protects the country at large.

"Should a vessel arrive at this port with cholera on board, and the national quarantine station be closed, the ship would be placed at the greatest distance from line of travel (say three fourths of a mile), and guard-boats, with most reliable crews, would prevent any communication with or from her, excepting the quarantine physician, who would have to remain and look after the sick. Telegraphic communication would be opened at once with the authorities at Washington, asking the immediate opening of the national quarantine station. If such station was opened, the vessel would be sent there. If it was not opened, the health authorities of Savannah would have to assume the responsibility, and do the best in their power to prevent the spread of the disease.

"In closing I cannot refrain from an expression of condemnation and protest against the unreliability of the ordinary bills of health issued by some consuls of the United States. They are worse than useless: they are dangerous. It is a frequent occurrence that clean bills of health are issued by them at ports where deadly epidemic diseases are prevailing. There should be some remedy for such pernicious and questionable conduct. Again: I know positively that steamships, from districts of Spain affected terribly with cholera, have been admitted into one of the largest ports of the United States during this season, without the slightest attempt at fumigation of the clothing of seamen, or cleansing of vessels, the statement being made to me in official correspondence, that as no sickness had occurred during the voyage it was deemed unnecessary to use any precautions, and that this would be the line of action pursued in the future at that port."

Dr. Jas. S. Blain, health officer of Brunswick, answers:

1. The quarantine facilities of Brunswick are not so perfect as I would like to have them, but they have proven sufficient to protect this city from all epidemic, infectious, and contagious diseases since the yellow fever epidemic of 1876.

2. I inspect all vessels at a distance of from four to ten miles from the city. All vessels are inspected before permission is granted to proceed to the city.

3. Vessels are purified and disinfected,—first, by the discharge of all ballast or cargo; secondly, the planking along the keelson is taken up, all filth collected in the limbers of the vessel taken out, and the vessel thoroughly washed and pumped out, salt water being used until the vessel is perfectly clean; thirdly, a strong solution of carbolic acid and sulphate of iron is applied to the whole interior, and the vessel is then fumigated by burning from 100 to 300 lbs. of sulphur in the cabin, forecastle, and hold of the vessel. All bedding and clothing of the crew is subjected to cleansing and disinfection. All infected or suspected vessels are detained ten days after cleansing: then, if no case of disease appears, the vessel receives a permit to proceed to the city.

4. The quarantine station is four miles from the city. It is not out of the line of travel, but no intercourse with vessels in quarantine is permitted.

5. All vessels with sickness on board, and all vessels from cholera infected or suspected ports whether or not having sickness on board, are sent to Sapelo sound. All pilots and steam tugs on this bar have permanent instructions to order all vessels with sickness on board or from cholera-infected ports to Sapelo sound. Pilots are not permitted to board such a vessel, but are instructed to direct or conduct them to Sapelo sound. After discharge from the national quarantine station, all vessels are again inspected at this quarantine station before receiving a permit to proceed to the city.

FLORIDA.

Notwithstanding its extended coast of nearly 1,200 miles, Florida has few harbors inviting foreign commerce, and, except Fernandina and Pensacola, the relations of its seven

ports of entry to the interior are limited. A state enactment, approved February 16, 1885, provides for the appointment of county boards of health which are clothed with full power to act in regard to all matters pertaining to quarantine, to appoint a port inspector and other officers, to declare and establish quarantine and provide rules and regulations for its enforcement, and "after the establishment of any quarantine against any port or place, any person violating the same shall be deemed guilty of a felony, and, upon conviction thereof, shall be punished by a fine of not more than five hundred dollars, or by imprisonment in the state penitentiary not more than one year."

Under this law the quarantine of the port of Pensacola is now administered by the Escambia county board of health. The station is on Santa Rosa island, about nine miles from the port, and is described by the quarantine physician, Dr. White, in reply to my inquiries addressed to Dr. R. B. S. Hargis, as being supplied with "all the buildings necessary for quarantine purposes. Vessels are inspected at the station. Vessels detained are required to discharge all ballast; and after discharge of ballast, the vessel is thoroughly cleansed and washed in all its parts, then fumigated, using twelve pounds of sulphur to every one hundred tons registered, the fumigation lasting twelve hours. After fumigation, a saturated solution of copperas is poured through the air-streaks, between each timber, running down to bilge; lime-water (whitewash) used in the same manner. The entire hold is then whitewashed, lime put in bilge to the forecastle, with bedding, clothing, etc., under the same process of cleansing, fumigation, etc., the cabin receiving same attention.

"It is not probable that a vessel with cholera on board will arrive at this station, as all vessels arriving outside the entrance of the port upon which any contagious, infectious, or pestilential disease occurred during the voyage are sent to Ship island, the pilot co-operating with the local authorities in directing them to that station. Should, however, a vessel get to this station with cholera on board, and in such a condition that she could not be sent to Ship island, the sick would, if possible, be cared for in hospital, and the vessel put in best sanitary condition, and such bedding, clothing, etc., as could not be disinfected, would be destroyed."

Dr. Alexander, port physician at St. Augustine, writes that the quarantine flag for that port "stands about one and three fourths mile from the city, where all vessels from a distance are inspected. Coasting vessels, or those plying between this and near ports, are allowed to come to the wharf for inspection, provided there is no sickness on board; if there is, then they share the quarantine ground as all others. Even upon coming to the wharf no communication is allowed until inspected. Our pilots are required to learn from the captain, before boarding a vessel, whether she is from a suspected port, or has on board a suspected case. In the first case, she is brought with as little contact as possible inside the harbor, there anchored, and report made to port physician and board of health. If sickness is on board, she is directed to proceed directly to Sapelo sound refuge station without boarding or entering harbor here.

"Should necessity demand the treatment of a vessel, we would use the disinfectants recommended by the National Board of Health, and adopted generally, viz., sulphur, sulphate of iron, carbolic acid, etc., subjecting cargo, clothing, bed-clothes, etc., to the same, and burn what might endanger after-disinfection.

"A vessel entering with contagious disease would not be allowed to remain one hour, as the condition of our harbor would subject the whole city to immediate infection: even should a vessel coming from foreign ports be in perfect health and condition, she must stop at quarantine ground, and all circumstances connected with her trip be well considered by the board of health before allowing her to come up.

"The coast map will show our unfortunate position as far as receiving or entertaining a vessel with disease on board. Our proximity to the high seas, the short and extremely narrow inlet, could but endanger us under the most favorable circumstances, as the small craft or pleasure boat would pass less than one hundred yards from the anchorage."

No responses have been received to repeated requests for information from Key West and elsewhere.

ALABAMA.

The coast quarantine of Alabama is limited to one port of entry, Mobile; and concerning this, Dr. Jerome Cochran, the state health officer, has kindly furnished, in response to my questions, the following succinct replies, which fully cover all the important points:

1. The Mobile quarantine station is chiefly an inspection station, but has the ordinary appliances of disinfection.

2. The entrance from the Gulf of Mexico into the Bay of Mobile is thirty miles from the city, and vessels are boarded for inspection at this entrance.

3. Vessels from infected ports with no sickness on board are disinfected anyhow before they are allowed to approach the wharfs.

4. Vessels with any infectious sickness on board, or having had any cases during the voyage, are sent at once to Ship island. Such vessels are not allowed to enter the bay at all until released from quarantine by the Ship island officials.

5. Mobile is thoroughly in earnest about her quarantines, and no infectious disease has been introduced through the quarantine into the city since the war. Such outbreaks as we have had have been the result of infection brought overland from New Orleans.

6. Any vessel having on board at the time of its arrival, or having had on board at any time during the voyage, yellow fever or cholera, would be sent to Ship island at once, and not allowed to enter the bay at all until discharged from the station, and even then, if there was any suspicion that she still remained dangerous, she would be disinfected anew at our own station.

MISSISSIPPI.

The county boards of health of Hancock, Harrison, and Jackson counties control the maritime quarantines of Mississippi. There is no direct foreign commerce, but Bay St. Louis has a large coasting trade with Mobile and New Orleans, and acquires some quarantine importance in consequence.

LOUISIANA.

The quarantine system of Louisiana is under the control of the state board of health, which is authorized by various acts of the state legislature to fix the duration of quarantine and to make and enforce all necessary regulations, to contract for building, employ persons, etc. At its discretion the board may at any time cause the detention at the quarantine stations for disinfection, fumigation, and purification, of any or all vessels from ports in which yellow fever usually prevails, or from ports where other contagious or infectious disease is reported to exist. Quarantine stations are established by law on the Mississippi river not less than seventy miles below New Orleans, at the Rigolettes—the entrance to Lake Pontchartrain—and below Morgan City on the Atchafalaya. But the state board is also empowered to establish additional stations upon any of the approaches to the city of New Orleans, in its discretion.

Under this latter authority the present board has recently established a refuge station in Pas a L'Outre, some twenty-eight miles below the original station, which latter is on the right bank of the Mississippi, seventy-five miles below New Orleans. A boarding station is also maintained at Eadsport, at the head of the jetties.

Accompanied by Dr. Joseph Holt, president of the state board, and to whose indefatigable energy the recent practical improvements are mainly due, I made a personal inspection of the Mississippi river stations on the 15th, 16th, and 17th of July last, and witnessed the inspection of vessels, the disinfection and treatment of an arrival from an infected port—a 2,000-ton iron steamer; inspected another which had been treated two days before my arrival and was not yet released; examined the appliances for disinfection, etc., and the buildings, hospitals, warehouse, and other items of the quarantine plant. I am therefore enabled to endorse from personal observation the claim made that this is the most thorough and vigorous system of sanitary quarantine which has ever been enforced for the protection of a port from the introduction of foreign contagion into this country, if not in the world.

Beginning with the arrival of a vessel in soundings, she is met by the pilot, who co-operates with the quarantine authorities, and is frequently accompanied by the medical

officer from the boarding and inspection station at Eadsport. This officer examines the ship's log, and receives a sworn statement from the captain as to the sanitary history of his vessel and her voyage, beginning at the port of departure. All on board are mustered and carefully examined for cases of suspicious sickness. If the vessel be found in good sanitary condition and free from infection she is allowed to proceed up the river, but reports at the upper quarantine station for a second inspection. If from a non-infected port, she is now given free pratique, and proceeds to the city. If from an infected or scheduled port, or if any suspicious development has occurred in the interim after first inspection, she is either subjected to treatment at the upper station or sent below to the refuge station, as the circumstances demand. For example: A short time before my visit a Mexican steamer had arrived; she was inspected at the boarding station, and all hands mustered and examined as usual, without detecting any suspicious illness. After she had been allowed to depart, the pilot reported that a sick man had been roused from his berth to be mustered with the crew. The fact was at once telegraphed to the upper station, and on the arrival of the vessel the man was found to be suffering with what proved to be yellow fever. The vessel with the sick man on board was at once sent down to the refuge station for necessary treatment, entirely out of the track of commerce.

If a vessel on first inspection be found infected, she is not allowed to proceed up the river, but is at once sent to the refuge station, the sick are removed to the hospital, and the vessel is treated as hereinafter described. After being thoroughly cleansed and disinfected, she is then sent to the upper station, where the compromised passengers and crew are subjected to a quarantine of observation during the usual period of incubation—depending upon the character of the disease. For the accommodation of these the large government warehouse is utilized. Meanwhile, the vessel may be allowed to proceed to the city in charge of an acclimated crew, or her cargo may be sent up on lighters, at the discretion of the quarantine authorities.

There is one medical officer on duty at the boarding station, one at the refuge station, and two at the upper quarantine—together with the necessary guards, boatmen, stevedores, nurses, and other employés. All the stations are in telegraphic communication with each other and with the office of the state board in New Orleans.

The following extracts from recent letters of Dr. Holt, written me since my visit, sufficiently explain the other details of the present quarantine administration for the protection of the Gulf gateway to the Mississippi valley. Improvements in minor points have since been made, and others will undoubtedly follow as experience shows their necessity. Under date of September 8th Dr. Holt writes,—

The system comprehends two stations. The lower station, for the reception of infected vessels only, is situated at Pas a L'Outre, an unused outlet of the Mississippi. The isolation of this place is complete, while affording anchorage to vessels of any tonnage. As soon as a vessel arrives in this station the sick are removed to the hospital, where every provision is now made for their proper entertainment and treatment. Preparatory to the disinfection of a vessel, persons are removed ashore and detained there until this process is thoroughly accomplished.

Pending the construction of a receiving wharf and warehouse, the freight, when the requirements of disinfection make it necessary, is discharged into barges, and every part of the vessel is then subjected to thorough treatment. This consists in cleansing of the bilge, and flooding it with bichloride of mercury in solution, one part to one thousand of water. All surfaces within the hold or below decks are freely wetted with the same solution, applied as a spray from a large watering rose, similar to those used in garden watering-pots, supplied through a two-inch hose, from an elevated tank on the wharf, or from a tank by means of a powerful hand-pump aboard the quarantine tug-boat. The freight in the barge or after its return aboard ship, is subjected to the protracted action of concentrated sulphurous-acid gas. This is applied in the following manner: Aboard the tug there is a compact battery of twelve furnaces for the rapid combustion of sulphur in large quantity. The furnaces measure each three feet six inches in length by twelve inches broad and seven inches in height, and contain each a cast-iron pan three feet long, one foot wide, and two inches deep. These furnaces open into a large reservoir, to which is connected a driving or exhaust fan capable of displacing about six thousand cubic feet

of air per minute. It is driven by an engine which derives its steam from the tug boilers. The sulphurous fumes are conveyed to the close barge or into the hold of a ship through a tube of galvanized iron, jointed in the manner of a stove-pipe, twelve inches in diameter, and of a length necessary to reach any part of the ship required. We have now substituted for this a hose of asbestos cloth. The vessel is detained at this station until there is every assurance of her being no longer infected.

The Upper Quarantine station, situated on the left bank of the Mississippi, thirty miles above its outlets, is the regular station at which all vessels *en route* to the city are required to stop and undergo in spection. Those hailing from inter-tropical American and West Indian ports, and from all the ports of France, and from the Mediterranean, are subjected to the process of disinfection with the mercuric solution and the sulphurous fumes described. Every article of ship's bedding, etc., sailor's luggage, clothing and baggage of officers and passengers, is taken ashore, where, on the wharf, it is wetted with the disenfectant solution.

Not having as yet satisfactorily completed our drying chambers, this part of the process is still inconvenient. It is desirable that all of these articles should be dried out and returned aboard ship as early as possible. In the meantime the vessel has been treated by the disinfectant wetting in every part, and every particle of the atmosphere heretofore contained in her has been displaced by the sulphurous acid gas.

Vessels, together with their cargoes, officers, passengers, and crew, coming from ports infected with yellow fever, are compelled to remain in quarantine a period of five days from moment of arrival, for observation, in order to give a reasonable assurance against the presence of the disease in its incubatory stages.

"The entire treatment of a vessel to prevent the introduction of cholera, yellow fever, or small-pox, is so exacting and so rigorous as to occasion no little grumbling on the part of those who must undergo it. This is particularly the case with officers and others aboard Mexican, Spanish, and Italian vessels. These persons resent any effort at sanitary treatment as a personal affront, while, in fact, they most require it. They are utterly without feeling, and indifferent as to whether they convey to our port cholera, yellow fever, or the plague. The Americans, English, French, and Germans are reasonable in this matter. I mention this as a simple matter of experience in regard to nationalities, as we have to deal with them in quarantine.

"Our quarantine methods represent the introduction of a system of maritime sanitation which has already suggested many particulars of improvement, and has opened to our view a broad field of sanitary enterprise far wider in its possibilities of good,—first, in giving the highest attainable quarantine against the introduction of pestilential diseases, and, secondly, in removing foolish and untrustworthy restriction, destructive of international commerce and travel. We have demonstrated by practical experience that the entire plan of treating ships in quarantine, or maritime sanitation, can be operated at a very moderate cost in ports doing a small business in shipping."

The following passages from the letter referred to are of special interest:

In using the bichloride of mercury we know that we have one of the most powerful of all the germicidal agents. Practical test in municipal disinfection and in quarantine has demonstrated its absolute freedom from injury to those having to do with it. In the operation of maritime sanitation, our employés have been wet with the solution from head to heels, and for hours at a time, without having as yet shown the slightest evidence of mercurialization. The clothing and other baggage of passengers and crew have been soaked in it without the slightest injury to persons or fabrics. Injury to the latter has always been due to the water and not to the chemical. The decks, cabins, bunks, and every available part of the vessels have been freely drenched with the solution without injury.

The sulphurous-acid gas, used as the displacing agent of the atmosphere below deck, has long since proved itself the most reliable gaseous disinfectant and the least injurious to cargo of any yet tried. As applied in our quarantine, it is like turning loose a volcano into the hold of a ship. The amount of sulphur used on any one vessel varies from one hundred and fifty to nearly three hundred pounds, so applied as to displace with immense force every particle of air contained in the bilge, between the planking, or skin, and ceil-

ing, in all parts of the cargo and dunnage. So searching are these fumes under the operation of the law of the diffusion of gases, favored by high pressure and rapid motion of currents, that a bowl of rain water, buried in the heart of a cargo of coffee, seventy-five feet distant from the conveying hose, was found distinctly impregnated with sulphurous acid. The effect upon the coffee itself, when dry and in good condition, was not observable. By getting the hose well into the dunnage, we can now treat a cargo of coffee with a thoroughness never before contemplated, and without the extra expense to shippers or consignees of a dollar, as against from five hundred to eighteen hundred dollars in times past, when quarantine treatment involved discharging and reloading cargo, and the employment of a great gang of stevedores, barges, tugs, etc., and even then the disinfection was utterly worthless, as proven by the subsequent appearance of yellow fever on the ship in port. If recent observations on the destructive influence of mineral acids, even greatly diluted, on the cholera virus are true, then we have in this agent the most efficient adjunct to the mercuric solution.

As an instance of unexpected difficulties met with in practice, the amalgamating powers of the mercury salt on pumps, fittings of hose, nozzles, spray roses, etc., presented for awhile a most formidable difficulty, finally overcome in a simple and economical way. The rapidly destructive effect of the heated sulphurous-acid gas upon all flexible hose of organic composition, compelled us to adopt the galvanized iron tubing, heavy and excessively awkward in use. This I have completely overcome by having had manufactured a close-woven, twilled, or corduroyed asbestos cloth. While a perfect non-conductor of heat, this material is abundantly light, and is proof against acids or heat.

Under date of November 11, 1885, Dr. Holt writes,—" In reply to your letter No. 20,867, I have the honor to state that we are maintaining a careful guard in the inspection of all vessels from Mediterranean ports. The process of bichloride disinfection is enforced, however perfect the health record and clean the bill of health, including a careful attention to bilge. The only modification in the full force of treatment is the omission of the atmospheric displacement by the sulphurous blast. This feature of our system was discontinued November 1, the end of our regular quarantine season.

" We are rapidly constructing an immense heating chamber, supplied with a double steam coil from a twenty horse-power boiler. The builders (Chicago) insure the easy and speedy attainment of 250° F. This will be used in addition to the bi-chloride mercury wetting. Any vessel not giving proof of continued good health, or, in other words, showing any ground for suspicion, will be remanded to the lower station, where she will be subjected to prolonged and vigorous treatment.

" The new system has paid out of itself every dollar of running expenses. We will open it in perfect working order as to every detail early in May next. We are fully impressed with the necessity of maintaining vigilance in regard to cholera."[1]

TEXAS.

The quarantine system of Texas covers a coast line of some 500 miles, extending from the mouth of the Sabine at the Louisiana boundary to the mouth of the Rio Grande. Upon the recommendation of Dr. R. M. Swearingen, the state health officer, the law has recently been changed so as to relieve local boards of health of the responsibilities of this coast quarantine, and the governor is authorized to appoint state quarantine officers, and has sole control of them in the enforcement of the quarantine laws. This change was inaugurated in the spring of 1883, and stations have since been established and equipped at the six ports of entry, as follows:

At Brazos de Santiago, near the mouth of the Rio Grande, and covering the port of Brownsville, the commercial gateway to the lower valley;

At Aransas Pass, covering the gulf entrance to Corpus Christi bay;

At Pass Cavallo, the entrance to Indianola;

At Velasco, at the mouth of the Brazos river;

On the east end of Galveston island, for the port of Galveston;

At Sabine Pass, the terminus of the Texas Trunk Railway.

Of these stations, that at Galveston is by far the most important, and its quarantine equipment is described by Dr. Swearingen as consisting of a steam tug fitted up with hot-

[1] Cholera was introduced into this country through this port in Dec., 1848, and in Feb., 1873.

air chambers and modern appliances for the disinfection of a vessel and cargo; a disinfecting warehouse with a capacity for treating 4,000 sacks of coffee at one time; and a station-house,—the whole plant representing an outlay of about $55,000.

The station is on the east end of the island, about two miles from the city. Vessels from suspected ports are inspected beyond the bar, ten or twelve miles south-east of the station, and are detained there, if considered dangerous, until the exact facts are determined. If actually infected, they are not permitted to cross the bar, but are ordered to the Ship island refuge station. If from an infected or interdicted port, a quarantine of detention of twenty days is rigorously enforced, during which period the cargo may be removed by lighters to the disinfecting warehouse, and the vessel be suitably treated. From May 1 to the close of the quarantine season in November, 1884, 939 vessels were inspected at this station, and seventeen of these were subjected to the twenty days detention. All vessels are inspected coming from south of 25° north latitude, and the enforcement of the regulations results in a practical exclusion of vessels from Mexican, Cuban, and Brazilian ports during the summer and fall.

Yellow fever is the disease most dreaded, and the quarantine system has been framed and heretofore administered with reference to its exclusion. The Mexican authorities have coöperated by establishing a quarantine at Bagdad, in aid of the station at Brazos Santiago, covering the lower mouth of the Rio Grande, and have adopted the same rules and regulations as those enforced at the Texas ports.

An inspection of transatlantic steamers with reference to cholera is now maintained at the six Texas stations, and will be continued throughout the winter. As late as November 10th of this year there were several steamers from cholera-infected ports on the Mediterranean detained in quarantine off Galveston. The vessels are not allowed to come to the wharf, but are unloaded and loaded again by lighters.

A communication from State Health Officer Swearingen to the governor of the state, commenting upon the efforts to establish an international quarantine, incidentally but fully sets forth the principles upon which the Texas quarantine system is based.

"Another very material variance between the authorities of the state and those of Mexico is the length of time thought to be necessary for vessels from infected places, or places liable to infection, to remain in quarantine before granting them free pratique. The Mexican Congress of Hygiene limits the period to ten days, for what they are pleased to designate 'the rigorous quarantine,' while in Texas twenty days is the universal rule.

"If we had disinfecting warehouses at every port of entry, and steam tugs supplied with powerful exhaust fans that could drive out the impure air from the holds of ships, and immediately after force into every nook and crevice germicidal gases, the ten days period of detention would probably be sufficient; but without these appliances of purification a longer time unquestionably gives greater security.

"In making the above declaration I do not lose sight of the fact that an infected vessel, without treatment of any kind, at the end of twenty, thirty, or even sixty days' quarantine, is possibly more dangerous than on the first day of arrival. The history of yellow fever gives abundant evidence that the poison does not retain its infectious quality for a long period when exposed to pure air, and that its proliferous properties are lost. The reverse is equally true. In warm, moist, impure air, its infectious quality seems to have no limitation, and of course such condition must favor its multiplication. With these facts conceded, the corollary is unavoidable, that the number of germs will increase when left undisturbed in the hold of a vessel, where all these favorable conditions are found. Without a warehouse for transferring goods, we cannot in ten days, by opening every aperture for ventilation, by shifting cargo, pumping out bilge-water, and the free use of germicidal gases, so disturb the condition of things as to pronounce the ship, crew, and cargo innocuous.

"Again: All persons are not equally susceptible to the poison of yellow fever, and the period of incubation does not usually commence the first day of exposure. If such was not the case, every unacclimated person in an infected city would be down about the same time, and epidemics would be confined to a few days instead of a few weeks. Assuming, then, that the cargo of a ship is infected, and that it will take ten days for the crew to discharge it, the probabilities are that with the majority of them the period of incuba-

tion would commence on the eighth, ninth, or tenth day, instead of the first, second, or third day, after the work of discharging had exposed them to infection. It follows, then, that a ten days quarantine, when each day brings additional exposure to those who must handle the infected goods, offers every opportunity for the germs of yellow fever to be inoculated before the period of detention expires, and for the denouement to be made afterwards. * * *

"Twenty days' quarantine for ships from interdicted places, ten for handling cargoes, and ten more to give time for incubation, has been the rule so long governing the ports of Texas that it might be properly classed among the unwritten laws of the state. It is a conservative period,—a kind of half way chronological station between the opponents of quarantine on the one side, and the advocates of total non-intercourse on the other. Under that rule we have had no epidemic, nor have our commercial relations been seriously impaired by it. The guaranty given of freedom from infectious diseases more than compensates for the losses sustained by a policy that must necessarily divert certain currents of trade into other channels.

"The people of Texas, satisfied with the system under which they have prospered for so many years, will be unwilling to take new departures until the etiology of yellow fever is more thoroughly comprehended, and science discovers more powerful agents for its destruction than we now possess. With due deference to the distinguished sanitarians who compose the congress of hygiene in our sister republic, we could not accept the ten days period of detention 'as a base for any agreement that might be entered into.' * *"

Since the date of the letter from which the foregoing extracts are made (September, 1884) the "appliances for purification" have been furnished at the Galveston station. But Dr. Swearingen remarks, in a recent letter to me, "Although we have [at Galveston] every facility for inaugurating a quarantine more in harmony with the views of sanitarians, our people are not yet prepared for experiments."

As to land quarantines, Dr. Swearingen says,—"Railways in Mexico make it possible for persons, freight, etc., to be transported from Vera Cruz to any city in Texas within five days, via El Paso or Laredo. Quarantine stations for the first time were this year established at those points. I have not attempted even an inspection service against small-pox in Mexico. It would be purely ornamental if I did so. The Rio Grande is a shallow stream, and from El Paso to Brownsville, by the river bed, is probably two thousand miles. Smuggling is carried on extensively, and the United States government cannot prevent it. A quarantine officer at any point would only be a notice to these organized bands, and to the travellers of both republics, that they would have to cross the river higher up or lower down,—'only this and nothing more.'

"I can enforce with some reason an embargo against persons from Vera Cruz when yellow fever prevails there, for that city is the only nidus of infection; but when small-pox is all over the country, the extreme folly of such a thing as an inspection at railway crossings is too apparent to be discussed."

Should cholera be introduced into Mexico and become epidemic there, the same conditions would then obtain with reference to the exclusion of that contagion. Dr. Swearingen adds, however, that Texas "will coöperate with the authorities of other states in any defensive action against cholera importation that may be indicated by the American Public Health Association."

NATIONAL REFUGE STATIONS.

There still remains to notice the Refuge Stations in Sapelo sound,—off the coast of Georgia,—and on Ship island in Mississippi sound. These were originally projected by the National Board of Health as part of a system intended for the protection of the minor ports, by providing fully equipped establishments for the care and treatment of infected vessels. Only the Ship island station was completed on an adequate scale; and its chief importance as a safeguard to the Mississippi river and the port of New Orleans has been largely superseded by the establishment of a refuge station in Pas a L'Outre by the Louisiana State Board of Health.

These stations, Sapelo sound and Ship island, are now in charge of the marine hospital service, together with those in Hampton Roads and at the Delaware Breakwater already described.

XVIII.

NOTES ON THE RELATIONS OF RAIN-FALL AND WATER-SUPPLY TO CHOLERA.

By HENRY B. BAKER, M. D.,
Lansing, Mich.

If we can learn what lessens cholera in its home, the knowledge ought to be useful to us in our efforts for its prevention, and for its restriction in case it reaches us.

The last annual report (for 1884) of the health officer of Calcutta (J. O'Brien, M. A., M. D., Surgeon-Major) contains interesting statistics, especially when considered in connection with reports by the health officers who have preceded him, and with statistics supplied by Dr. J. M. Cunningham, Surgeon-General Indian Medical Department, in his work *Cholera: What can the State do to prevent it?* From these and other sources, such as the *Encyclopædia Britannica*, *Archiv für Hygiene*, etc., I have prepared a few statistical tables and diagrams showing the relations which deaths from cholera sustain to the rain-fall in countries where statistics of both of these phenomena can be had for many years, where cholera is endemic, and the deaths from cholera can be counted by the thousands. In statistics of such large numbers, all minor or accidental fluctuations tend to disappear.

The table (I), which I have had copied for distribution to such of you as wish it, shows the deaths from cholera in Calcutta in each month in the past twenty years ending with 1884. From the table it may be seen that an important change occurred in the cholera mortality in the year 1870, and that from that time to the present the mortality has been only about one third of what it was previous to that date.[1]

[1] Studying the statistics closely, it will be seen that the reduction in the mortality from cholera occurred in the latter part of the year 1869. On page 113, *Report on Sanitary Measures in India in* 1876–'7, etc., presented to parliament, London, England, 1878, in an abstract from remarks by Arthur J. Payne, M. D., Surgeon-Major, Health Officer of Calcutta, it is said,—"The water-supply, from the mode of its introduction, was calculated to act, if it acted at all, in a sudden and conspicuous manner. * * * The hydrants were completed in August, 1869, and on the last day of that month they were supplied with pure water. The process was repeated on a few occasions in September and October following, and from the first of November a full and regular supply was maintained." "A glance at the table is sufficient to show that in some manner or other a new era of cholera production opened towards the end of 1869. The fall in that year was strongly marked, and sufficiently well sustained to indicate a particular cause for it, and unless it can be shown that there was a similar fall elsewhere in productive places, which should point to cosmical or other general influence at work, it must be inferred that the agency was local." The statistics have since shown that the reduction in the mortality was local, and that Dr. Payne's explanation of the great reduction of mortality from cholera at that time was probably the true one.

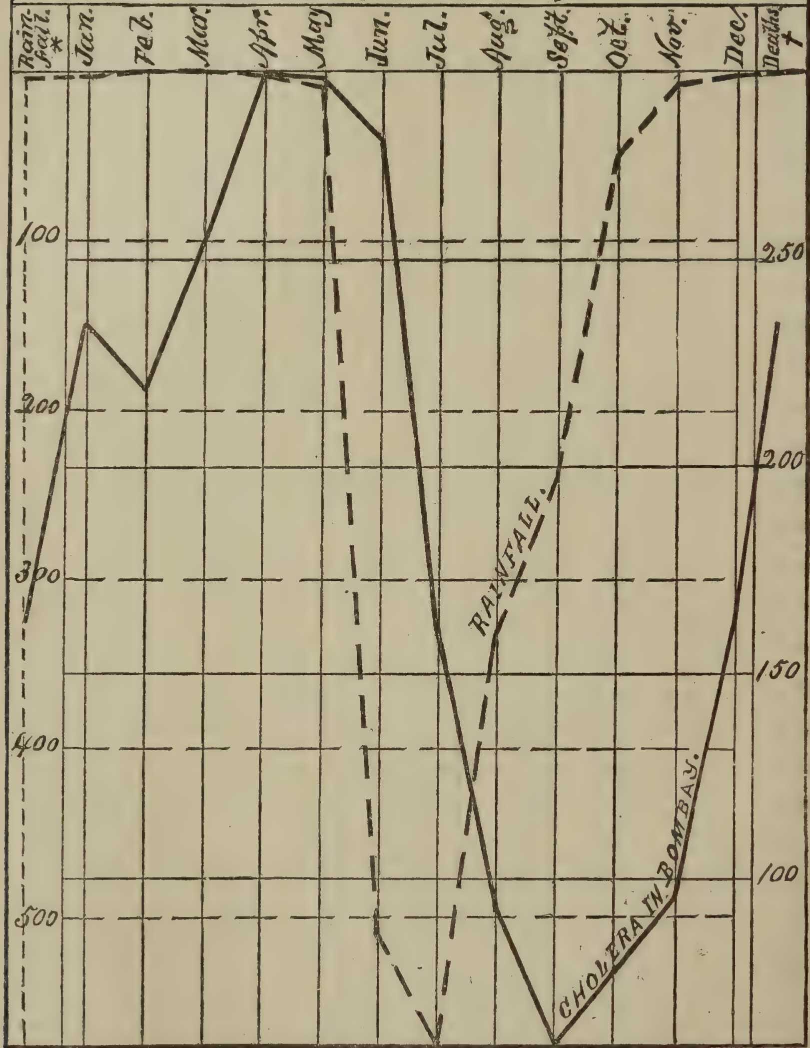
TABLE I.

Deaths from Cholera in Calcutta, India, by months, in the years 1865–1884 *inclusive.*

["Table No. XV," page 20, annual report for 1884 by J. O'Brien, M. A., M. D., Surgeon-Major, Health Officer of Calcutta.]

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Ratio p'r 1,000 of population, census of 1881.
1865 . . .	136	396	508	756	400	131	162	392	496	432	817	452	5,078	11.7
1866 . . .	509	826	1193	736	616	885	552	491	371	236	203	208	6,826	15.7
1867 . . .	67	142	292	343	315	137	108	56	150	277	243	140	2,270	5.2
1868 . . .	252	328	694	591	360	174	97	395	188	350	405	352	4,186	9.6
1869 . . .	264	428	759	745	697	336	77	52	40	56	77	57	3,582	8.2
Mean numbers	245	424	689	634	477	332	199	277	249	270	349	241	4,388	10.1
1870 . . .	171	259	257	381	165	118	50	40	29	36	21	31	1,558	3.5
1871 . . .	53	96	55	85	29	23	25	41	69	85	127	108	796	1.8
1872 . . .	77	78	61	67	63	52	68	76	57	82	177	244	1,102	2.5
1873 . . .	129	185	217	159	149	95	55	27	22	20	23	24	1,105	2.5
1874 . . .	62	175	186	243	210	79	35	32	17	22	60	124	1,245	2.8
1875 . . .	126	69	264	264	115	62	28	31	50	145	353	167	1,674	3.8
1876 . . .	90	226	324	268	168	126	42	32	31	41	259	244	1,851	4.2
1877 . . .	251	130	174	184	76	28	26	77	119	162	85	106	1,418	3.2
1878 . . .	65	98	312	308	131	47	39	57	45	34	84	118	1,338	3
1879 . . .	73	58	145	175	318	223	56	21	19	17	21	60	1,186	2.7
1880 . . .	71	114	90	71	47	11	17	22	18	55	170	119	805	1.8
1881 . . .	63	72	227	370	138	36	49	59	80	100	232	267	1,693	3.9
1882 . . .	129	111	170	318	380	254	54	52	38	91	232	411	2,240	5.1
1883 . . .	204	129	227	490	393	130	38	38	38	162	103	85	2,037	4.7
Mean numbers	112	129	193	242	170	92	42	43	45	75	139	150	1,432	3.3
1884 . . .	36	123	486	847	283	129	54	29	44	49	114	78	2,272	5.2
Suburban, '84	72	170	465	811	301	153	66	41	38	50	127	127	2,421	9.6

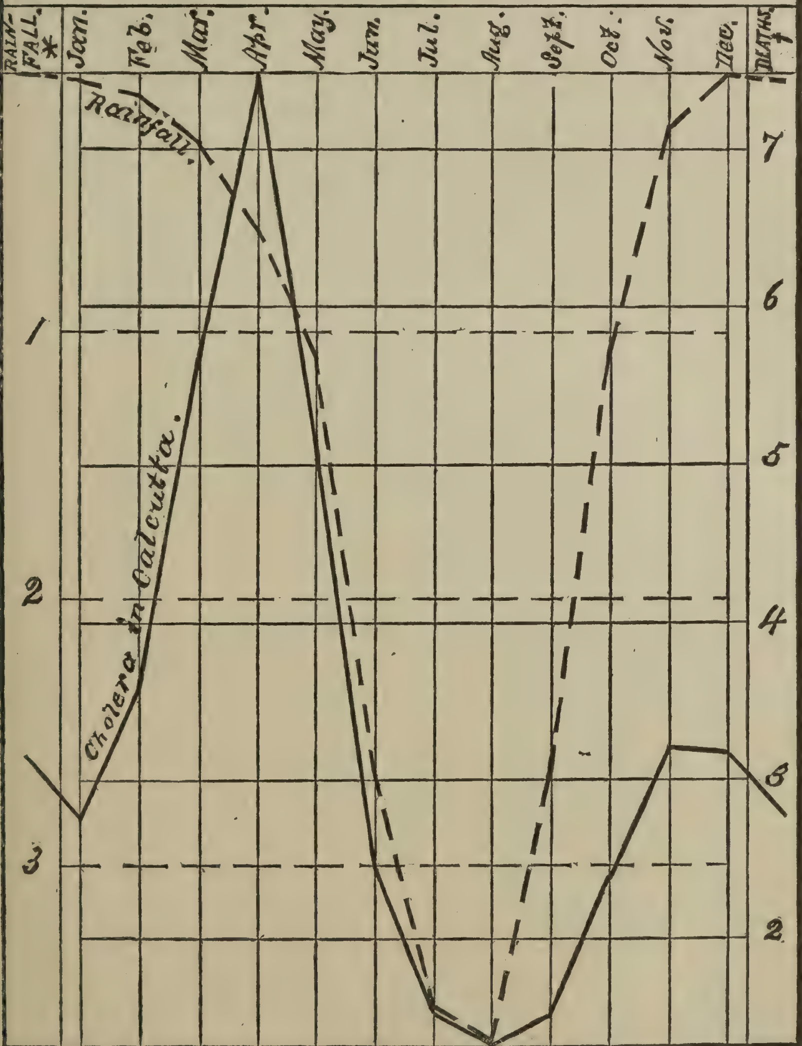
DIAGRAM 1.—Relation of Rainfall to Cholera. Average monthly rainfall and average monthly Deaths from Cholera in Bombay, 15 years,—1851–1865.‡ (The curve for rainfall is reversed,—the scale increases downwards.)



Des. by Henry B. Baker.

*Scale, 100mm rainfall to .90 inches vertically.
†Scale, 50 deaths to 1.10 inches vertically.
‡From table on page 182, Archiv für Hygiene, Zweiter Band, 2 Heft. Article by Prof. Franz Hofmann.

DIAGRAM 2.—Relation of Rainfall to Cholera[a].
Average monthly rainfall, and average monthly Deaths[b] from Cholera in Calcutta, 26 years (ending with 1865?)



Des. by Henry B. Baker.

*Scale, 100mm rainfall to 1.42 inches vertically.
†Scale, 100 Deaths to .84 of an inch vertically.
[a]The curve for rainfall is reversed,—scale increases downwards
[b]From table by Prof. Franz Hofmann, on page 182 Archiv für Hygiene, Zweiter Band, 2 Heft. Leipzig, 1884.

A reduction of two thirds of the mortality from cholera (a saving of about three thousand lives a year in one city) is of such importance as to warrant much effort to learn its cause.

Dr. J. O'Brien, surgeon-major, the present health officer, asks attention again to the fact, and to its coincidence with the completion of the water-works, which, since 1870 (Nov. 1, 1869), have supplied filtered water to many of the inhabitants of Calcutta. He says,—" Reviewing this epoch according to the quinquenniums, into which we find it almost naturally divided by the variations of the intensity of cholera, we have first what might be called the pre-sanitary period—the period prior to the great sanitary event of the introduction of a pure water-supply, extending from 1865 to 1869. During this period cholera maintained what may be termed a maximum rate. The total deaths were 21,942, and the yearly average, 4,388. Next follows a period of minimum prevalence, the lowest figures being found in 1871—the lowest for the whole twenty years. The total deaths in these five years were 5,806, and the yearly average, 1,161."

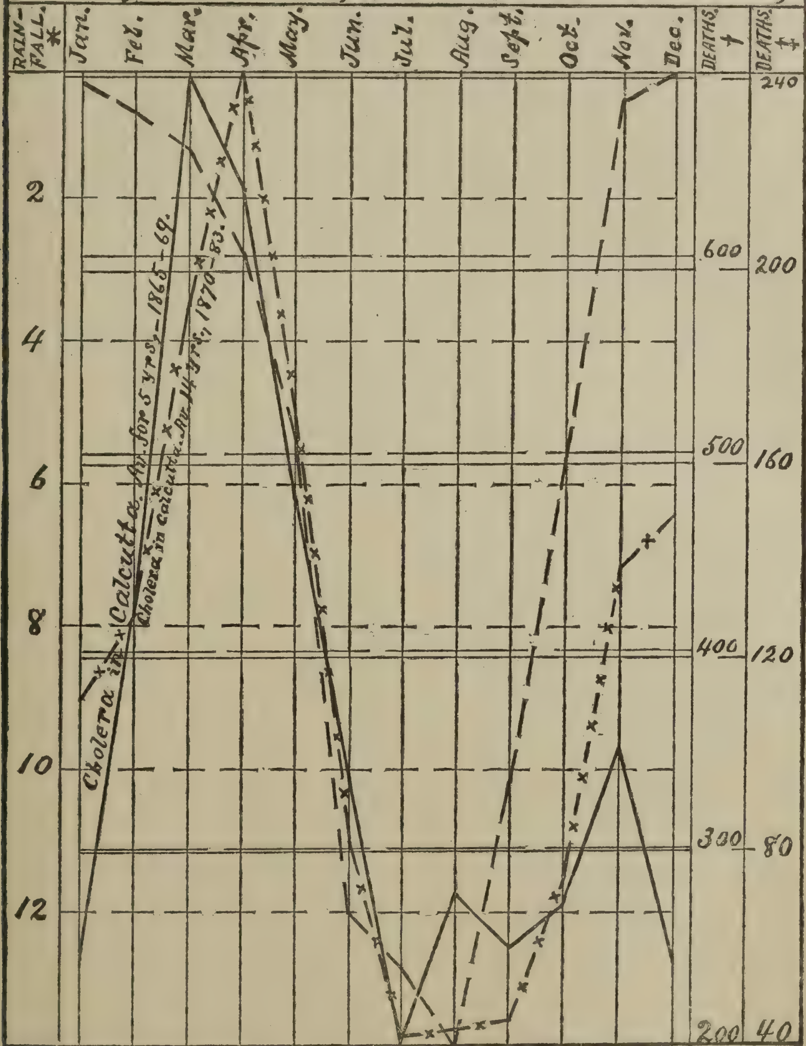
Dr. Cunningham says,—" In Calcutta the introduction of good water was immediately followed by a marked decrease in cholera, and this decrease, although it has not fulfilled the promise with which it commenced, yet has certainly distinguished the period since the new water was laid on, as compared with the period before its introduction." Then, again,—" The cholera mortality, although happily reduced, has observed the same relative prevalence according to season as it did before—the yearly rise in the spring, the decline in the rains, and the increase again in the end of the year."[1]

In one of the diagrams which I have caused to be distributed among you (No. 3), this same prevalence by months before and since the water-supply is well shown, and also the relation of cholera to the rains, as mentioned by Dr. Cunningham. (That diagram shows, however, that since the introduction of water, the month of greatest mortality from cholera in Calcutta is April, while before that time it had been in March.) In all the diagrams of cholera at Calcutta and vicinity, and at Bombay, there are shown to be remarkably strong relations of the cholera mortality to the rain-fall, the cholera increasing soon after the rain-fall has decreased, and decreasing soon after the rain-fall has increased. It is worthy of note, also, that at Bombay, where the rain-fall does not begin until June, the cholera does not begin to decrease until June, while at Calcutta the earlier rain-fall in the spring is followed by an earlier decline of the cholera mortality, it decreasing very much in May. At both Calcutta and Bombay the cholera mortality falls soon after the rains have come, and this notwithstanding it is in the hottest season of the year.

In the months of December and January, and sometimes in February and March, the cholera mortality in Calcutta seems to be lower than would be expected from the mortality in months immediately preceding

[1] "Cholera: What can the State do to prevent it?" p. 90.

DIAGRAM 3.—Relation of rainfall to Cholera.[a] Average monthly rainfall for 48 years, and average monthly Deaths from Cholera in Calcutta,—Average for 5 years,—1865-69, and for 14 years,—1870-83.—(The Curve for Rainfall is reversed,—the Scale increases downwards.)



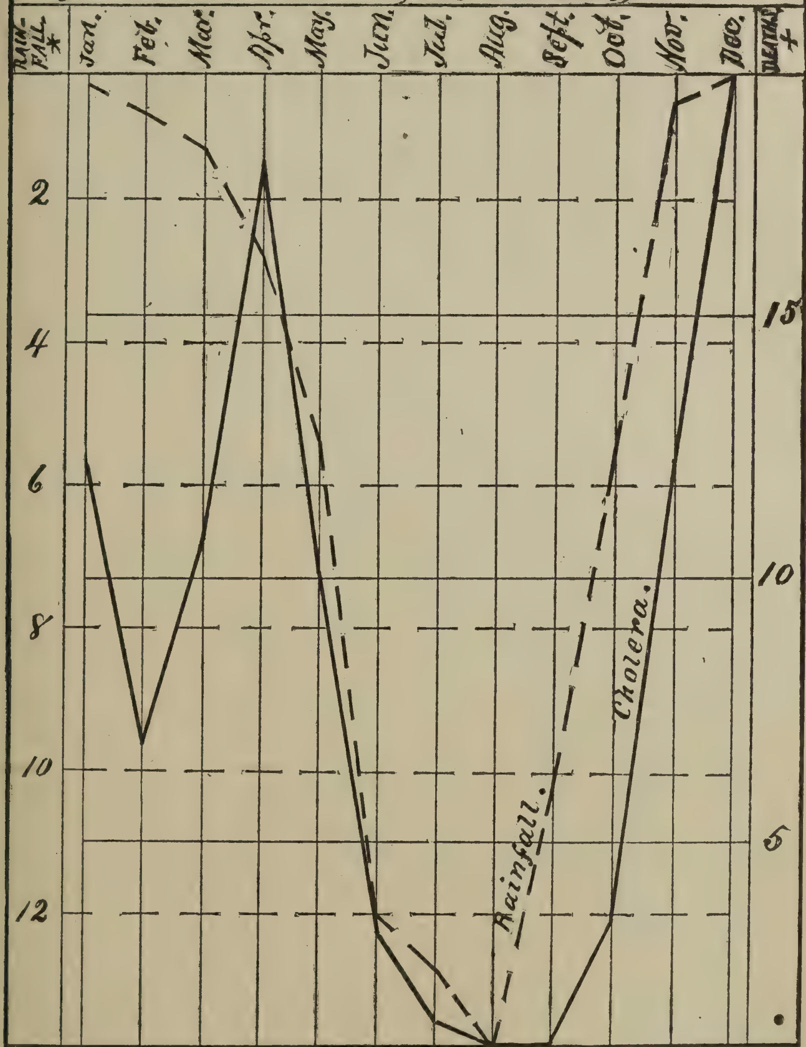
Des. by Henry B. Baker.

*Scale, 2 inches of rainfall to .38 of an inch vertically.
†Scale, 100 deaths to 1.05 inches vertically.—Av. 5 years.
‡Scale, 40 deaths to 1.03 inches vertically.—Av. 14 years.
[a]Data from pages 2 and 20, Report for 1884, of J. O. Brien, M.A., M.D., Health Officer of Calcutta.

and succeeding. Those two months are the coldest in the year, the temperature being eleven degrees lower in those months than the average for the year. Inasmuch as the cholera declines after the rains come, even in the hottest weather, it is not at first plain why the coldest weather should lower the cholera, as, according to the deaths registered, it is lowered even at the driest time of year; but perhaps the explanation may in part[1] be found in the lessened amount of water, good and bad, drank in the coldest weather. The health officer in Calcutta quotes the chairman as saying,—"Some 300,000 or 400,000 more gallons per diem are sent into the town during the hot weather than at other seasons. So you will see that the idea of the water failing in the hot weather does not at all correctly represent the state of things. The real difficulty is in the increased demand made upon the supply in the hot weather. In the cold weather people do not want so much water." We seem to be warranted in inferring that if 300,000 or 400,000 gallons less of water per day are demanded by those who use from the general water-supply, which, on the whole, is known to be inadequate, a considerably less quantity, also, of the tank water and water from bad wells is used during the coldest weather; so that if cholera can be caused by bad drinking-water, there would be lessened opportunity for the causation of cholera by bad water in the cold months of December and January.

[1]A careful study of the diagram (No. 4) leads to the belief that the imperfections in the registration of deaths in the twenty districts in India, represented in that diagram, may be greatest in the earliest months of each year, and that a larger proportion of the deaths which occur are registered in the later than in the earlier months. This may be the case wherever the deaths are not uniformly placed upon record immediately after their occurrence, and are enumerated near the close of the year. It has been shown that in Michigan, where the deaths are collected after the close of the year in which they occur, the omissions in the returns of deaths are somewhat in proportion to the length of time which has elapsed since their occurrence; and a diagram of the *deaths* from a certain disease (pneumonia, for instance), which has strongly marked relations to climatic conditions, reveals a want of harmony in the several months similar to that shown in the diagram (No. 4) here given relative to cholera, while a diagram exhibiting the *sickness* by months from the same disease (pneumonia) shows that no such want of harmony applies to the sickness, that being put upon record at the close of each week, and therefore more uniformly correct than the statistics of deaths. If the deaths from cholera in India are enumerated by a census, or in some other manner are recorded near the close of the year in which they occur, then the line representing deaths in the diagram (No. 4) should probably be so raised throughout the first part of the year that it would be at the right hand of the line representing rain-fall in nearly every month, as it is in that part of the diagram relating to the last half of the year. I regret that I have been unable to learn, in time to incorporate it in this paper, the exact mode of obtaining the statistics of deaths in India; but my diagrams reveal evidence that a part of the inharmonious lowness of the apparent death-rate in the early months of the year is probably due to the registration of a smaller proportion of the deaths which occur at that season of the year.

DIAGRAM 4.—Relation of rainfall to Cholera[a]. Average Monthly Rainfall in Calcutta for 48 years[b] and average Deaths from Cholera monthly, in the 20 Districts near Calcutta forming the Central Portion of the endemic area, in India, for the 12 years 1871–82[c]. (664,797 Deaths.)



Des. by Henry B. Baker.

*Scale, 2 inches rainfall to .38 of an inch vertically.
†Scale, 5 per cent of deaths to 1.4 inches vertically.
[a]The curve for rainfall is reversed,—Scale increases downwards.
[b]Data relative to rainfall from page 2, Report for 1884, of J. O. Brien, M.A., M.D., Surgeon Major, Health Officer of Calcutta.
[c]Mortality Statistics from page 145 "Cholera: what can the State do to prevent it?" by J. M. Cunningham, M.D., etc., etc.

TABLE II.

Exhibiting the Number and Per Cent. of Deaths registered from Cholera in twenty districts forming the central portion of the Endemic Area of Cholera in India, during the twelve years 1871–1882.

[Abstracted from page 145 "Cholera: What can the State do to prevent it?" by J. M. Cunningham, M. D.]

Months.	Numbers of Deaths from Cholera.	Per Cent. of Deaths in each Month.
January	80,258	12.1
February	45,049	6.8
March	70,735	10.7
April	119,089	17.9
May	67,141	10.1
June	21,977	3.3
July	10,193	1.5
August	7,568	1.1
September	7,593	1.1
October	23,124	3.5
November	81,239	12.2
December	130,831	19.7
Total	664,797	100.00

The last column in Table II is graphically represented in Diagram 4, page 161.

By the table I present (Table I), it may be seen that the year 1880 was remarkable for the low mortality from cholera in Calcutta. By a table on page 1 of the annual report of the health officer of that city for 1880, it may be seen that the rain-fall in 1880 was six inches greater than the mean for forty-eight years; and the health officer remarks that the rain-fall was "plentiful, and well distributed over the year."

Dr. Cunningham's remark, that the decrease following the introduction of water "has not fulfilled the promise with which it commenced," probably refers to the increased cholera mortality in 1882, 1883, and 1884. Relative to 1882, the health officer (Dr. K. McLeod) says, "The rain-fall of the year fell short by but two tenths of an inch of the mean fall of the preceding forty-eight years." But he adds, "The distribution of the fall departed in some respects from the fall of former years, February and October receiving an undue share of the total, and June, July, and August less than the wonted amount."

Relative to 1883, the quarterly reports of the health officer show the

rain-fall to have been 13.8[1] inches less than the mean for forty-eight years.

Relative to 1884, the health officer, on page 1, report for 1884, says, "The meteorology of 1884 was characterized by great drouth and excessive heat in the early part of the year. In the preceding year the rainfall was short of the average by 17 inches, and from 1st January to 15th April, 1884, the entire rain-fall was less than half an inch." And again, on page 24, he says, "The lesser mortality of the present year [1885], I have no hesitation in saying, is due in a great measure to more favorable weather. In 1884 there was a great drouth and intense heat; in the first four months in the present year the heat has been tempered and the surface moistened by seasonable showers, and the wind has blown more frequently from the north."

Dr. Cunningham[2] says, "The suburbs have as yet no proper water-supply, and they suffer in much larger proportion than the city itself, but the rise and fall of the disease in the two is synchronous. When cholera is at its height in the one, it is at its height in the other; when it is at its lowest in the one, it is at its lowest in the other. The facts show that though Calcutta has benefited largely from the improvement in its local conditions, it is still subject, though in a minor degree, to the same general influence of the suburbs, where no such improvement has been effected."

One of the diagrams (No. 5) which I submit shows that for the year 1884 the curve for the suburbs is similar to that for Calcutta, the two lines running together for March, April, and May, and nearly together in all the months. It also shows that in Calcutta and in the suburbs the cholera-mortality curves bear striking relations to the curve representing the rain-fall. That diagram, however, includes data for only one year.

In further illustration of what Dr. Cunningham says, the table which I submit (Table I) shows that the mortality from cholera in the suburbs in 1884 was 9.6 per 1,000 of the population, and in Calcutta only 5.2; and since 1870, when the water-supply was introduced, it has been, on the average, only 3.3, while before 1870, 1865–'69, it was 10.1.

Besides the introduction of water there have been other important sanitary improvements in Calcutta, such as the work by active health officers, and by means of sewers, etc., which must not be ignored. The sewerage and drainage of Calcutta, which was commenced in 1859, and estimated to cost about £800,000,[3] was not complete in 1874, but had then cost about £620,000, or about $3,000,000.[4] But the apparent fact that before and after the great reduction of cholera in 1870 the rise and fall of the mortality from cholera followed so closely the decrease and increase of the rain-fall as to indicate some necessary relation between the two phenomena, taken with the fact of the very great and nearly per-

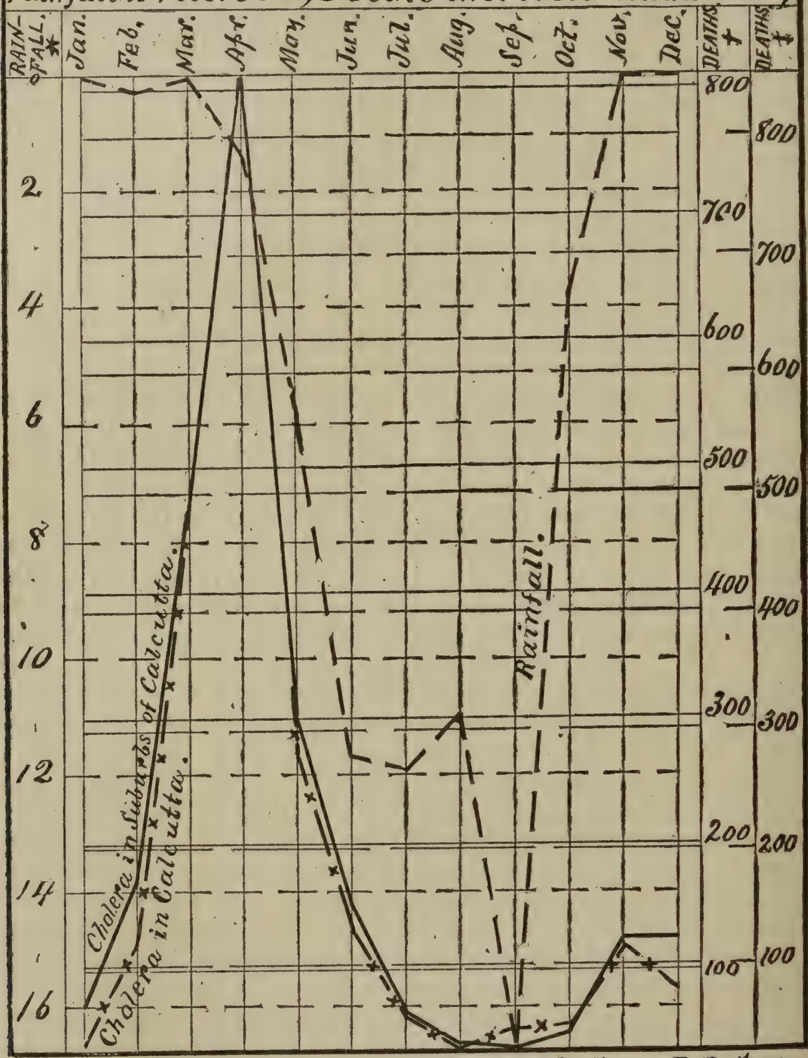
[1] The health officer says 17 inches, but he refers to the year ending March, 1884.

[2] "Cholera: What can the State do to prevent it?" p. 91.

[3] Pages 181, 183, Van Nostrand's Engineering Magazine, vol. 13, 1875.

[4] Page 658, Encyclopædia Britannica.

DIAGRAM 5.—Relation of Rainfall to Cholera.[a] Average monthly rainfall, and average monthly Deaths from Cholera in City, and in Suburbs, of Calcutta during the year 1884. (The curve for rainfall is reversed,—Scale increases downwards.)



Des. by Henry B. Baker.

*Scale, 2 inches rainfall to .62 of an inch vertically.
†Scale, 100 deaths (in Suburbs) to .67 of an inch vertically.
‡Scale, 100 deaths (in Calcutta) to .63 of an inch vertically.
[a]Data from pages 2 and 20, Report for 1884, of J. O. Brien, M. A., M. D., Health Officer of Calcutta.

manent reduction of the mortality coincident with the introduction of a filtered general water-supply, would seem to make it extremely probable that the increase of the rain-fall influences cholera by supplying a better water for drinking and other purposes, and that the reduction of the cholera mortality in Calcutta in 1870 was due in great part directly to the improved water-supply.

To summarize: From what has here been presented, it appears,—

1. That the mortality from cholera in Calcutta was reduced by about two thirds, coincidently with the introduction of a good water-supply.

2. That before and since the introduction of good water, the rain-fall has apparently controlled the rise and fall of mortality from cholera in Calcutta.

3. That the rain-fall has apparently controlled the mortality from cholera in the suburbs of Calcutta, and in Bombay.

4. That, if two thirds of the mortality from cholera disappears by a supply of good water, and the original whole and remaining one third are both controlled by the rain-fall, there is a strong inference that the remaining one third of the cholera mortality in Calcutta might be very materially lessened by such a supply of good water as would reach and entirely supply every inhabitant.

5. If the prevention of cholera in its home is so largely dependent upon the rain-fall and upon a good water-supply, one direction is thus indicated for most successful efforts for its prevention in this country.

XIX.

SMALL-POX IN CANADA, AND THE METHODS OF DEALING WITH IT IN THE DIFFERENT PROVINCES.

By PETER H. BRYCE, M. D., Secretary Provincial Board of Health,
Toronto, Ontario.

I feel in some measure as if I stand before an audience in whose eyes I shall be likened to the lawyer for the defence in a criminal action at court, since, while in the eyes of the sanitary world a crime has been committed,—that of having an epidemic of small-pox in Canada,—I shall appear to many to be defending the case of a criminal who has been bold enough to say "Not guilty." But while, on this account, I have some diffidence in appearing before the association, I have still a greater fear before my eyes, viz., that of being accused before my own countrymen of being unpatriotic, by reason of having told to this association, and through it the American people, that Canadians are, judging from the stern logic of facts, far behind the age in sanitary matters; that they have a low estimate of the value of human life; and that there exists in Canada a disregard for law, such as the people of this glorious Union are strangers to.

To me, at the present moment, occur three of the few Latin quotations which the lapse of years has not yet obliterated, and I give them to you, all three at once, so that you may con them over, and be able to say, at the conclusion of this paper, which one is most apt in its application to my remarks upon the subject discussed.

Ne crede equo,—in other words, Do not believe the equine (which, being freely translated, means the Canadian).

Ex uno disce omnes—From the condition of one province, learn that of all. And,—

A particulare ad universale arguere non justum est,—that is, Do not be sure that what is true of the particular, is equally so of the general or universal.

From time to time in Canada, as in different parts of the Union, past years have seen outbreaks of small-pox. The years 1881 and 1882 saw several very considerable outbreaks; and 1882 saw the Provincial Board of Health formed in Ontario.

It will be remembered that 1881 saw an epidemic in England amounting, in the metropolis, to six hundred and twenty deaths to one million of population, and that most of the small-pox in America, of 1881 and the

succeeding year, could be traced to this foreign source. This led to strict quarantine restrictions being placed upon all vessels arriving at New York, Boston, and other ports, and to the organization, under the state board of New York especially, of a system of immigrant inspection. During that year the only serious outbreak in Ontario was at Windsor, opposite Detroit. It was quickly stamped out by the local health authorities, there having been twenty-five cases in all. The year 1883 saw very few outbreaks in Ontario, the only serious one having been in an isolated part of the province, among navvies on the line of the C. P. R., north of Lake Superior. The year 1884 was a much more important one as regards small-pox outbreaks, but in none of them except one did the disease get beyond the first case and those exposed to it. Of these outbreaks I may state the origin, and one or two facts in connection with each.

1. In January a lumberman, sent out to the settlements, travelled by train during the stage of invasion, and was finally isolated by Dr. Powell, of Edgar, there being no second cases.

2. A man and his wife, by steamship Peruvian, landed at Halifax in March. Wife became sick after travelling to Woodstock; was isolated in an old farm-house, and nursed by her husband, but died. The rural board disinfected him, and allowed him to depart before incubation period was over. He went to Goderich, was taken sick, slept with children in the house of a relative, was driven by a doctor to the station, was detected on the train, and was finally isolated at London. After recovery he was imprisoned, and the Goderich doctor fined for his outrageous action.

3. The next outbreak was in the person of a G. T. R. workman at Point Edward, opposite Port Huron. Through imperfect diagnosis, and after persistent self-assertion on the part of the medical man that it was *black measles*, the case was allowed to infect others in the boarding-house, and sent two cases to Detroit, two more in Point Edward, and to Millbrook, near Stratford. It infected no other cases.

4. The next case was in Flos township, in the person of a lady who contracted the disease in a first-class railway coach. No second cases occurred.

5. The next case was in the person of a young man, an immigrant on the Steamship Polynesian, who arrived at Toronto in the end of May, feeling unwell. He left the city immediately, and developed small-pox in Victoria county, to where he was traced. He infected two families, but the disease was promptly stamped out.

6. There were no further outbreaks until October, when the Hungerford outbreak took place. It began in the person of an Irish boy from a Liverpool orphanage—one of a number who were brought out by a benevolent church organization and placed with Hungerford farmers. Whether the boy contracted the disease on ship-board, or from clothing which had been given him in Liverpool, could not be determined. Suffice it to say, that two children in the house where the boy was sent took

the disease, it being in the case of all of them mild, and, occurring in a French Canadian settlement, was thought nothing of. The disease was spread by a man who travelled with a threshing-machine, sleeping in the room with these sick children. He kept moving about from farm-house to farm-house, during the next three weeks after incubation, until so sick that he went to bed in one of the houses in a small settlement. There he died: but none thought it small-pox, nor was it thought more than black measles by a local doctor, until it had caused the man's death and that of quite a number of others. An old local practitioner was then sent into the district by the reeve, and it was declared small-pox by him at once; but the infection had been disseminated in all directions, and within three weeks from its diagnosis had inoculated some two hundred persons, and was present in three townships. On the 29th of November the provincial board assumed control of the district, and on the 12th of December, from this large number of centres of infection, with the exception of two cases from stolen infected clothing in February, Hungerford had its last case of inoculation. The surrounding townships, which had cases by infection from Hungerford, had the disease limited in almost every instance to first cases or their families.

April, 1885, saw a short-lived outbreak in Prince Edward county, and a case was taken to Winnipeg from Hungerford, and left recollections in Minnesota of its having passed that way.

But a cloud no bigger than a man's hand at this time was gathering in the east. On the 23d of April, Alderman Gray, chairman of the civic board of health, Montreal, wrote to me in the following terms:

"MONTREAL, April 23, 1885.

"There were two cases, both Pullman-car conductors, who arrived here. One was sent to the Hotel Dieu, and the other was isolated in his own house; consequently we had two *foci* of the disease to fight. By great exertion, the one in the private house was—although all the inmates took the malady—confined, and no other cases have resulted from it. The one sent to the Hotel Dieu spread to other patients, and I was obliged to open the civic small-pox hospital, which was closed when I took the chairmanship in March, and the second case resulting from the initial one was taken there. Up to date I have taken in nineteen cases, of which seven have died, and the others are doing well. No cases have occurred since Monday. Most of the cases which have died were not vaccinated, and those which were had only one mark."

From this time rumors, then denials, then confirmations of the rumors, were spread from Montreal, and although a city missionary had died from the disease, caught while making his rounds in the French quarter, it was not until Sir Francis Hincks, a prominent politician, died from the disease, brought, probably, to his house by a French servant, that the outside world, and thereafter Montreal itself, took alarm. Looking over the mortuary record from the time of Alderman Gray's letter, it would seem as if he had reason for the statement made by him on April 23,—that he thought he had seen the last case,—since by the end of June there were returned only, April, 6 deaths; May, 10 deaths; June, 13 deaths;—a total of 29. Thenceforward the disease may fairly be said to

have obtained the mastery, since July nearly doubled the previous three months with 52 deaths, and August quadrupled July with 250. This was almost quadrupled again by September, with 829 deaths; and this was increased by one half by October, with 1,243 deaths. But the fight for existence had, ere this, been fairly begun, and November saw a decided decrease in deaths, there being registered for the 27th only 14, and the weekly averages per diem for the month being 33, 25, 20, 10, respectively. Up to the 21st of November, the number of houses registered in the health office, Montreal, as having had small-pox in them, was 3,145; but this does not include all. Calculating roughly, we have, as the results of seven months of small-pox, 3,001 deaths, or nearly one for every infected house.

Unfortunately this epidemic has not been confined to Montreal, but is still widely present in many of the suburbs of that city, and has been introduced into many of the towns and villages of the province of Quebec. Knowing that vaccination in that province had been almost totally neglected amongst the French, and that there was, moreover, a complete absence of any provincial sanitary authority prepared to grapple with the epidemic, the provincial board of Ontario took early advantage of its powers to press forward local health organizations to a point of still greater completeness than had been reached under the comprehensive health act of 1884. General warning to the public of Ontario was monthly given by the health bulletin, and municipal vaccination urged everywhere, both by the bulletin and circulars to local boards. This began to bear fruit in June, when a number of municipalities put into operation the powers of the compulsory vaccination act, which hitherto had been very generally neglected, vaccination having been previously carried on wholly by physicians in their private practice. The epidemic which had so recently occurred in Hungerford, and which had so well proved to the provincial board what effective organization could do, was a powerful lever to it in urging municipal action, while its occurrence had put the board in a position to ask and obtain adequate legislation for dealing yet more effectually than before had been possible with epidemic disease.

It will not be out of place to state here some of the clauses of the Ontario health act bearing upon this point:

Section 12, Public Health Act, 1884, requires the appointment, in every one of the six hundred and fifty municipalities, of a local board of health, by the municipal council; and section 19 gives the provincial board power to appoint where the councils fail to do so. The appointment of a medical health officer and sanitary inspector was made permissive, but not compulsory. Section 3 of the same act gave the board power to require, under sanction of the lieutenant-governor, the performance by local boards of most important duties during the existence of epidemic disease, but unfortunately did not give the provincial board the power to compel the appointment of a medical health officer and sanitary police, or to require the direct obedience to the provincial board of such officers, even though

appointed; nor was there any clause directly giving power to the provincial board to appoint such officers, and tax municipal funds for their payment. The emergencies arising in the Hungerford epidemic made those *lacunæ* so evident, that the government introduced an amendment, 1885, directly dealing with these difficulties.

The following clauses—2, 3, 4, 5, 6, 7, 8, and sub-section 11 of sec. 12—amply illustrate the powers of the board to deal with epidemic disease:

CHAPTER 45.

AN ACT TO MAKE FURTHER PROVISION REGARDING THE PUBLIC HEALTH.

[Assented to 30th March, 1885.]

Her Majesty, by and with the advice and consent of the legislative assembly of the province of Ontario, enacts as follows:

1. This act may be cited as *The Public Health Act*, 1885.

2. Whenever, from the presence of any formidable contagious disease in any locality, the Provincial Board of Health considers the appointment of a medical health officer necessary for the municipality in which such disease exists, or for any neighboring municipality, and requests the council of any such municipality to appoint a medical health officer, the council shall forthwith appoint a properly qualified medical practitioner to be medical health officer for the municipality.

3. If a council does not appoint a medical health officer within five days after a request in that behalf made by the provincial board, which request may be served upon the head of the council or its clerk, or mailed to either of such officers by registered letter-post, the lieutenant-governor, upon the recommendation of the provincial board, may appoint a medical health officer for such municipality.

4. Every medical health officer appointed by the municipal council shall hold office during the pleasure of the council; and if under the preceding section the medical health officer is appointed by the lieutenant-governor, he shall hold office until the first day of February in the year following that in which he is appointed: *Provided always*, that the municipal council may at any time, upon a two-thirds vote of its members, dismiss any medical health officer for a neglect of duty, and the decision of such council shall be final, and shall not render the corporation liable for any damages; the medical health officer shall be entitled to compensation for services actually rendered up to the time of such dismissal, but the amount of such compensation shall not exceed the salary he would have earned up to the time of such dismissal, and if his salary up to such time is paid, such payment shall be a bar to any other claim for services rendered.

5. Whenever, during the presence of any formidable contagious disease in any municipality or neighboring locality, any medical health officer becomes temporarily or permanently incapable of performing his duties, or resigns his office, or leaves the locality for which he has been appointed, the council shall forthwith appoint another medical health officer in his room.

6. Where two or more municipalities are united into a health district, the provisions of the preceding part of this act shall apply, except that the power and duty of appointing or removing a medical health officer shall be with the district board of health, unless the councils of the municipalities composing such health district have, previous to any request in that behalf being made by the provincial board, united in appointing a medical health officer for such municipalities, and the lieutenant-governor may, in case of their default, appoint a medical health officer for such district.

7. In case the appointment of a medical health officer is made by the Provincial Board of Health, he shall be entitled to recover from the municipality reasonable compensation for his services.

8. Where a medical health officer is appointed, he shall possess all the powers and authority possessed by any health officer or sanitary inspector under *The Public Health Act*, 1884, or any other act in force, and such medical health officer shall perform all duties imposed upon him by any regulations of the Provincial Board of Health, and the

fact that similar duties are by statute imposed upon the local board of health shall not relieve the medical health officer from the performance of such duties.

Section 12 amends sec. 3 of 1884, of which 11 is a sub-section.

(11) For requiring the appointment of sanitary police, to be paid by the municipalities in which they act, for the purpose of assisting and carrying out the health regulations in force in the municipality.

Although the possible invasion of cholera was the strong lever of the provincial board in gaining such powers, it seems nothing less than providential that the Hungerford outbreak occurred to give point to the board's demands, since without this legislation the action taken by the provincial board, in the crisis growing out of the Montreal scourge, would in many respects have been *ultra vires* and impossible.

Until August, action further than that already mentioned was not taken by the provincial board, as no case of small-pox had been imported from Montreal. In that month, however, a circular was sent to all local boards in the towns and townships lying along the trunk lines of railway and along the Ottawa and St. Lawrence rivers, requiring them to at once appoint medical health officers. This was very generally obeyed in those places which had hitherto neglected to take advantage of the powers of the general act of 1884.

In Cornwall occurred the first case, and it was closely followed by cases in Ottawa and Toronto, all being importations from Montreal. The local organizations in each of these places being complete, the cases were promptly isolated, and from them no second cases, except in same household, occurred, this being due to the late discovery of the nature of the cases.

About this time Detroit became alarmed, and the United States Marine Hospital Service established inspections at Port Huron and at Detroit. On the 28th of August, the chairman of the provincial board, in response to an invitation extended to him, left for Montreal to attend a conference of the transportation companies, which was held in the office of the consul-general of the United States in Montreal. In deference to his official position and continental reputation, Dr. C. W. Covernton was appointed chairman of the preliminary conference, held on the 28th of August.

The present state of the epidemic and the future outlook were discussed, and a number of resolutions were drawn up for consideration, to be discussed at an adjourned meeting to be held on the 4th of September. The report of this preliminary conference was forwarded to the provincial health office in Toronto the same night, and was reported the next day to the attorney-general, who at once directed the secretary to have regulations drawn up and approved by the board, under section 3, Public Health Act, 1884, and Public Health Act, 1885 *(vide ante)*, to be presented for the consideration of the government. This was done on the same day as the meeting of the adjourned conference in Montreal. The secretary of the provincial board was then directed to proceed at once to Port Huron and Detroit, to examine the inspections at those

points, and to advise regarding action, in concert with the Marine Hospital service, and with state and municipal health authorities. This was done, and Friday, the 4th of September, 1885, became a memorable day, for on this day the Ontario board's regulations became law, its two executive officers returned from the east and west limits of the province to report, and on the same day the lieutenant-governor of the province of Quebec signed an order in council appointing a central board for that province. The Ontario regulations were gazetted the next day, and on that day the provincial board met, heard the chairman's and secretary's reports, and appointed its chief of inspectors' staff, Dr. T. S. Covernton, who had inspected the ground with the chairman during the preceding week. The plan of campaign was then laid out by the secretary of the board and the chief inspector, and the next day the inspector left for the scene of operations. The Ontario regulations went to Montreal with Dr. T. S. Covernton, and appeared in the Montreal papers on the same day they were given to the Toronto public. The plan in outline determined upon was, that the chief-of-staff should reside in Montreal, have enough inspectors to board every train and every boat leaving Montreal for Ontario ports, and to institute a close inspection of all goods and merchandise going into that province, issuing certificates in all cases where their freedom from infection was assured, and causing detention in all others.

The following are the regulations referred to above:

REGULATIONS ISSUED BY THE PROVINCIAL BOARD OF HEALTH IN THE MATTER OF SMALL-POX.

WHEREAS, owing to the prevalence of an epidemic of small-pox in Montreal, there is danger of the disease becoming epidemic in Ontario,—*therefore*, the Provincial Board of Health, subject to the approval of the lieutenant-governor in council, enacts the following regulations:

1. Wherever small-pox is present in any municipality in Ontario, the council of every such municipality, and of every municipality adjoining the same, shall at once appoint one or more sanitary policemen for the purpose of assisting to arrest the spread of the disease, and the council of any municipality in Ontario where the Provincial Board of Health deems the appointment of one or more sanitary policemen necessary, shall also make such appointment. If the medical health officer of the municipality, or the Provincial Board of Health, require the appointment of any specified number of sanitary policemen, then such number shall be appointed. In case the council of a municipality neglects or refuses to make the required appointments, the Provincial Board of Health may appoint as many sanitary policemen for such municipality as it deems necessary.

2. Any default on the part of the authorities of any municipality in taking immediate and effective action in carrying out the regulations of the Provincial Board of Health, or of any of the health acts of this province, or of any health by-law in force in the municipality, shall be at once reported by the medical health officer to the secretary of the provincial board, in order that the said board may take such measures as it deems requisite for placing the said municipality in a position, as regards its sanitary arrangements, to effectively combat the said disease.

3. On the occurrence of the first, or any, case of small-pox in a municipality, the medical health officer shall at once remove the person attacked to the isolation hospital, tent, or other place provided under section 44 of the Public Health Act, 1884, or cause such person to be otherwise efficiently isolated, and shall take proper measures for the

disinfection, or, if necessary, the destruction, of all clothing which may have been exposed to the contagion, and for the disinfection and purification of every conveyance, rail-car, steamboat, sailing-vessel, carriage, or other vehicle which may have been exposed to the contagion.

4. He shall further place in another building or tent, which shall be provided by the local board of health, all persons who may have been exposed to the contagion, and shall supply them with all necessaries until the period of incubation of the disease shall have elapsed; and no such person shall go, or be permitted to go, abroad until he or she has given satisfactory proof of successful vaccination within the preceding seven years, or shall have obtained a medical certificate of insusceptibility to the vaccine disease, nor until the clothing or effects worn or carried by or with him or her have been properly disinfected, if the same have been exposed to contagion.

5. When any vessel coming from an infected locality enters any port in Ontario, the medical health officer having jurisdiction in the port shall make a strict inspection of the vessel and examination of the passengers, officers, and crew, luggage, clothing, bedding, freight, or other effects, before any person, luggage, freight, or other thing is landed or allowed to be landed from it, and where any infected or exposed person is found on board, he or she shall be dealt with in the manner directed in the preceding regulation numbered four, and no luggage, freight, or other thing shall be landed from the vessel until they have been thoroughly disinfected.

6. With a view of preventing, by means of a systematic inspection of passengers, baggage, and cars, the introduction of infected persons, things, and conveyances into the province, the provincial board, during such time as the present epidemic of small-pox exists in Montreal, or an epidemic of small-pox exists in any other locality by which epidemic the health interests of this province are, in the opinion of the board, likely to be affected, may appoint medical inspectors, who shall perform such duties as may be assigned to them by the board, and may board all trains entering this province from Montreal, or such other locality, and all boats bearing passengers from Montreal, or such other locality, to Ontario ports, and any other train or boat suspected of having infected persons, luggage, freight, or other effects on board, and every such inspector may take, in respect of such persons, luggage, freight, or effects, any sanitary precaution authorized by any of the health acts of this province, or by any regulations issued by the Provincial Board of Health and sanctioned by the lieutenant-governor in council, which, in the opinion of such inspector, are expedient for the purpose of guarding against the further introduction of small-pox into Ontario. The inspector may require any person travelling on any such train or boat either to produce for examination by the inspector a medical certificate of such person having been vaccinated within the preceding seven years, or not being susceptible to the vaccine disease, or to exhibit to such inspector the marks on his or her person of successful vaccination, such as to satisfy the inspector that the same has been performed within seven years, and on default the inspector is empowered to vaccinate such person, either before he or she is permitted to leave the train or boat, or immediately thereafter, at his discretion; and each person so travelling shall answer truthfully all reasonable questions which an inspector shall, in the performance of his duty, ask such person with reference to the places such person has been at, and his or her stay there during the fourteen days next preceding such inquiry being made; and in case such person refuses or omits so to do, the inspector shall be justified in presuming that such person has been within such time exposed to infection, and in acting accordingly.

7. Local medical health officers and all other sanitary officers shall, whenever required by the medical inspectors appointed by the provincial board, aid such inspectors in providing for and compelling the removal of suspected or infected persons from trains or boats, and for isolating and vaccinating such persons, and for supplying them with medical aid; and the expenses attendant upon the discharge of such duties shall be borne by the provincial board in all cases where the persons for which they are performed are unable to pay therefor, and are not residents in the municipality in which they are taken care of.

8. In every municipality in which small-pox exists such local arrangements as are provided for by chapter 191 of the Revised Statutes of Ontario shall be made by the local

board of health for the systematic and compulsory performance of vaccination, wherever the council of any locality shall omit to make such arrangements, or may not be authorized by the said act to make the same. In every such municipality any person who has not been successfully vaccinated within seven years, or who does not hold a medical certificate of his or her insusceptibility to the vaccine disease, ascertained upon an attempt to vaccinate made within seven years, shall procure the vaccination of himself or herself within three days of being requested in writing by any health officer of the municipality to obtain vaccination, or within a like period after public notification by the local board of health directing general vaccination of the inhabitants of the municipality has been issued, and, in case such vaccination is not successful, every such person shall have the operation repeated until the same is successfully performed, or he or she obtains a certificate of insusceptibility to vaccine disease.

9. Until the publication of notice in the *Ontario Gazette*, removing the prohibition, no rags or clothing shipped by boat, rail-car, or other conveyance, as merchandise from Montreal or other infected locality, shall be landed or permitted to be landed in any part of the province, unless accompanied by a properly authenticated certificate from a health officer appointed under the health act of Ontario, or from some person approved of by the Provincial Board of Health certifying that the said articles had been properly disinfected before shipment, or were free from infection.

10. The medical inspectors, to whom is assigned the duty of inspecting trains and boats running from Montreal westerly, shall, in respect to the duties hereinafter mentioned, be governed by the following rules:

(1) An inspector shall attend at the railway station or steamboat wharf at Montreal a reasonable time prior to the departure of every boat or train going west, and shall, whenever he deems it expedient, take passage on such boat or train.

(2) He shall notice whether passengers have come off the trains or boats, or whether their journey commences at Montreal.

(3) He shall notice whether passengers have tickets direct from Montreal, or whether the dates on the tickets show that the passengers have probably stopped over there or elsewhere.

(4) He shall note the destination of all such persons.

(5) He shall obtain information as to the quarters whence they have come, and whether there is any reason to suspect their being infected.

(6) If the inspector believes that any such person is infected, or that his or her clothing or other effects contain infection, the inspector shall detain such person, and his or her clothing and effects aforesaid, at some convenient point *en route*, until the period of incubation is over, and the clothing and other effects shall be at once disinfected.

(7) If the medical inspector only suspects that any person on board, or the effects of any such person, have been exposed to infection, the medical inspector shall notify the medical health officer of the locality to which the person is going to meet the train or boat, and to keep the said person thereafter under observation.

(8) In either of the cases mentioned in the two next preceding rules, unless the person believed to be conveying or suspected of conveying contagion shows satisfactory proof of vaccination within seven years, or of insusceptibility to the vaccine disease, he shall be forthwith vaccinated, and, if necessary, shall be detained by the local health officer until vaccinated by him or some other proper person.

(9) The effects of persons regarding whom there is suspicion should be dealt with as directed by the Public Health Act, 1884.

(10) The action to be taken in the event of a case of small-pox being discovered is shortly as follows: (*a*) Detention and isolation of persons affected; (*b*) fumigation of car or boat; (*c*) vaccination of all persons who have been exposed to the contagion; (*d*) detention of any person who refuses to be vaccinated; (*e*) notification of local health officers at places of destination.

(11) The medical inspector to whom is assigned the duty of inspecting trains or boats running from any other place than Montreal shall be governed by the rules laid down in Regulation 10, substituting the name of such place for Montreal, and such rules shall apply in whatever direction the boat or train may run from such place.

To appreciate the boldness of the task undertaken by the Ontario board, and the delicacy, associated with firmness, required for its success, there are several points that must not be overlooked.

1. It had become a question of some doubt as to how far provincial powers could enable the board to undertake the inspection of trains, inasmuch as the authority over *through* or inter-provincial railways is in the hands of the Dominion government. This difficulty was, however, obviated by the readiness of the two trunk lines of railway to coöperate with the provincial board.

2. The second difficulty was that of the provincial board requiring of every merchant in Montreal compliance with its demands,—that each must have all goods for export fumigated properly to the satisfaction of the board, that all their employés be vaccinated, and that the homes of the employés be visited weekly to see that no small-pox existed in them, the infection of which might be carried to the warehouses.

3. The fact that in the metropolis of another province, with hundreds of prominent local physicians, the Ontario board had presumed to establish a sanitary inquisition, and to tell them that Ontario could not trust her interests in their hands; and this, too, in the face of the fact that the civic board of Montreal had agreed to appoint inspectors for all trains and boats leaving for the west. Every one will forgive the *amour propre*, which caused some newspaper comments, anything but complimentary to the Ontario board, to be made in the Montreal papers.

There were other but minor difficulties, which made the undertaking of the Provincial Board of Health of Ontario anything but a pleasant one. The duty of the board was, however, a plain one, viz., to keep small-pox from becoming epidemic in Ontario, and it took such action as was best calculated to effect that end.

All will see why this apparent invasion of Montreal seemed necessary.

(*a*) The various train inspectors could begin their work at once, both of removing dangerous persons, and of inspecting and vaccinating all others.

(*b*) They could all report to one chief, who in turn could report to the central office in Toronto.

(*c*) Vaccine and other necessaries could be supplied from one centre.

(*d*) All baggage for fumigation could be selected by the time Ontario was reached.

(*e*) No detention of trains at the Ontario boundary was necessary, as would have been had the board's inspection begun there.

(*f*) Merchants who were willing to carry out the board's suggestions could get their certificates from the Ontario office before shipping, and the chief inspector could satisfy himself, by personal inspection, of the precautions taken by them. This was a great boon to Montreal merchants, and they appreciated it, since by it thousands of orders were saved from cancellation.

(*g*) The non-existence of any train inspection by the central board of Quebec, not yet organized, and by the fact that the Montreal civic board

had not yet shown an activity equal to controlling the epidemic in that city, much less of protecting outside places.

Many other reasons might be given, but these were the principal ones. Provincial and race prejudice could not be wholly overlooked, or the publicly made statements that Toronto and the West were trying to ruin the trade of Montreal.

The triumph of the board over the difficulties, at first apparently so great, is a tribute to intelligent sanitation, and to the practical value of internal quarantine, so called, which, as facts presently to be presented will show, make it possible not only to destroy, but in a very remarkable degree to improvise, trade and commerce, by establishing confidence in the mind of the general public.

A confidence grew in the minds of Ontario importers and the whole people, that the goods which had the certificates of the Ontario board accompanying them were free from infection.

The first of those to appreciate the action taken by the Ontario board was a body of the most prominent merchants of the city, who had, with subdivisions, united in a merchants' sanitary association, and which had, for a week before the advent of the Ontario inspectors, been prosecuting vaccination and inspection of their employés and those in their homes, and in some cases had been fumigating goods intended for export. Their failing trade caused them to see, in Ontario's action, hope, and they at once seconded the board's efforts, and thus the granting of merchandise certificates began. From day to day the number of firms consenting to the board's conditions of granting certificates increased, and in only a few cases was a disregard for them shown. The demand made, in one instance, on the Grand Trunk Railway freight office not to forward some packages lacking certificates, since they would be stopped in Ontario, and which was at once assented to by the company, showed the shippers that there was no alternative, so that such an example of firmness had its effects on all; and as a consequence some twenty thousand merchandise certificates had been issued by the middle of October. There were associations of dry goods men, furriers, boot and shoe men, felt-workers, shirt-makers, etc., while rags were entirely refused shipment certificates.

Such was the work which gradually extended to the inspection of firms of all kinds doing business in Ontario. Within the first fortnight hundreds of orders had been cancelled. After that, by our action, the filled orders were accepted, and the panic regarding goods was over.

Local boards in Ontario, here and there, passed resolutions to keep out all Montreal goods; but advice in special instances enabled the provincial board to have such cancellation orders rescinded. The central office in Montreal became, however, an office where persons going West went for vaccination and certificates. In fact it was besieged from morning till night. The extension of the work of inspection to the trains was instituted on the same day as that in the city began, and by Wednesday, the 9th of September, every train and boat leaving the city of Montreal for Ontario was inspected by Ontario men. Owing to the novelty of the

work, all persons producing certificates of vaccination, or showing evidence on their persons of successful vaccination, were allowed to proceed West; but as within the next three weeks several new cases of small-pox had occurred in Ontario, two of them having been introduced from Montreal, the train inspectors were instructed to take no certificates unless signed by well known Quebec physicians, but to require evidence of vaccination in every case where there was any possibility of deception. This was made necessary by the fact of deception being used, owing to the use of forged certificates, or by certificates being given now and then by men less anxious to maintain their honor and their professional good name than they were to retain the favor of patients who came to them for certificates of vaccination.

The persistent refusal, in occasional instances, of certain travellers to be vaccinated, caused the officers much trouble, and hence detention stations west of the Ontario boundary became necessary. Sanitary police were appointed, and met every train at Lancaster, Alexandria, and Ottawa. Many of the experiences of the officers are both amusing and instructive, but do not require here any extended reference. The other part of the train-inspector's work—that of selecting out baggage for fumigation—was also undertaken and carried out in all cases where the character and point of departure seemed to indicate a necessity therefor. This matter, which was undertaken with characteristic thoroughness by the chief of inspection, was managed in the following way: He obtained, through the courtesy of the local board of health of Montreal, the numbers of all houses on the various streets where small-pox was or had been. When a passenger was asked if he came from Montreal, what street, and whether vaccinated, the inspector examined his note-book, with all the numbers entered on the streets, alphabetically arranged, and if the passenger came from such a house or near it, his checks were taken and his baggage was detained, at the various points of entry to the province, and fumigated. Judged by results, the system has proved most satisfactory. In not a single case that I am at present aware of has the disease been traced to infected baggage, while it has created much less trouble and inconvenience, not to say irritation, to travellers than would have been the case if wholesale, and, in my opinion, wholly unnecessary, fumigation had been carried out.

The system thus inaugurated, and which has been briefly set forth, was, as will be observed, similarly carrying out in detail the plans outlined in the resolutions of the meeting, of various interests already referred to, and, as stated in the first report sent me by the chief-of-staff, met with a gratifying approval from not only American Consul-General Anderson, but also from the Montreal Clothiers' Association, as stated in the letter of its chairman to the chairman of the Ontario board.

When the system of inspection thus outlined had been instituted, the inspector of the board was directed to set out and inspect the Ontario ports along the Ottawa. This was done, and communications with all health authorities in them were made with Montreal, they all being urged

to take whatever steps were demanded, both by the health act and the exigencies of the case.

At this time the alarm in outside places may be imagined, when a telegram reached Washington, D. C., stating that Toronto had had two hundred and thirty cases in August, when a United States order was issued to fumigate all Canadian mails, and when an American paper had a report that five hundred and forty persons had died in Montreal in one day!

On the 13th of September the chief-inspector wrote, "On all hands I receive strong commendations of the praiseworthy action of the provincial board of Ontario." This satisfactory feeling toward the work of the Provincial Board of Health showed itself in many ways, one of the chief being the frequent applications of different firms for our sanction to the issue by them of special circulars, showing that they were adopting systematic measures for fumigating goods and protecting their employés against small-pox, and also the fact that later the American inspector's staff took our own certificates from people going south.

Special precautions against the carrying of the infection on western-bound boats were taken in October, owing to one or two cases having been carried in this manner. As cases of small-pox existed in Quebec ports west of Montreal, it was thought desirable to have all boats inspected, as regards merchandise and crew, at the entrance to the Cornwall canal. This was done by utilizing the local medical health officer as a provincial officer. No cases have occurred from boats since this was done.

Early in October, advantage was taken of the visit of Dr. Rauch, of the Illinois state board, to the St. Lawrence quarantine station, to make him fully acquainted with the whole state of matters as regarded small-pox in Canada, and the precautions being taken in Montreal and Ontario for limiting its spread. This visit was most opportune, as it gave us the opportunity of bringing before American sanitary authorities certain facts which it was hoped would cause certain quarantine restrictions which had been passed upon Ontario travellers at Suspension bridge to be removed. At the time when this inspection was instituted it could not be objected to, since cases had occurred in St. Catharines, Hamilton, and London, the first cases in all instances, however, having been introduced before the Ontario inspection had begun. As this action seemed to the Ontario board, which was aware of how these cases were isolated, to bear with undue severity upon Grand Trunk Railway traffic, the chairman, Dr. C. W. Covernton, was, at the request of the Dominion government, delegated to visit Albany and Burlington, and while there interview Dr. Austin, chief of the U. S. Marine Hospital Service, in regard to the matter, while Surgeon-General Hamilton was communicated with by the board, the whole case being set plainly before him. Dr. Hamilton therefore took the matter up, and ascertained the views of the state boards most immediately interested in regard to it. The Ontario board naturally expected and obtained aid from Dr. Rauch, who was most

intimately acquainted with all that had been done in Ontario, and also from Dr. Austin, who had visited Montreal, where he saw the working of the Ontario system of inspection. Dr. Wheeler, U. S. Marine Hospital Service, stationed at Buffalo, was afterwards deputed by Dr. Hamilton to visit Toronto in regard to the matter, and the Ontario board obtained assurances from him that his influence would be toward the removal of the restrictions. Since his report Dr. Hamilton has consented to its removal only on condition that all Quebec baggage be fumigated on entering Ontario, stating as his reasons therefor that such a precaution was deemed necessary by those state and city boards most immediately interested. This we were not prepared to do unless the Grand Trunk Railway consented to the trouble and expense, since the previous success of our system, in preventing infected baggage going west, seemed to make such a wholesale fumigation still more unnecessary when the epidemic showed such marked signs of decline. There the matter stands, as the Grand Trunk Railway has not consented to such action.

During November there were in Ontario only some five fresh cases, outside of the ten in Ottawa and five in Toronto, none of which, so far as I know, were fresh importations from Montreal.

The internal organizations of the province during these months has probably been a work of even greater importance than that at the borders. Vaccination has been carried on in a manner wholly unknown before in the province, the compulsory clauses in the cases of the inhabitants of whole municipalities, and in very many regarding school-children, having been enforced. The appointment of medical health officers has been continuously carried on, until some three hundred regularly appointed officers exist, and in most other cases physicians are members of local boards. Small-pox hospitals have been erected in a considerable number of exposed places, and in others temporary hospitals have been secured for use, should occasion demand it. Every municipality practically may be said to have a local board, since, of the six hundred and fifty municipalities in the province, five hundred and sixty-five have reported boards, and those which have not are in most cases sparsely settled townships. When it is considered that this has been done in three years, and that in this time three health acts have been passed, this association, I think, may fairly say that Ontario has not been idle.

It is now my duty to refer to the work done in Quebec, and in doing so I cannot do better than read the statement of facts made by the chairman of the Quebec board, Dr. Hingston, in a circular letter recently published at the direction of the provincial board of Ontario and Quebec.[1]

This statement must, remembering the circumstances under which this central board of Quebec was formed, and, as Dr. Hingston says, the educating process which is necessary in sanitary matters is slow, be considered by every one most satisfactory. While nothing more definite is stated than the names of the one hundred and sixty-five places where boards are formed, and while I am aware that those, even where formed

[1] Dr. Hingston being present at the session, Dr. Bryce omitted this portion of his paper.

in the suburbs of Montreal, are not doing very efficient work, nevertheless it is a good beginning for the French province, so slow to become impregnated with the ideas of English-speaking communities, so ingrained is the sentiment—"*Nos lois, notre langue, et notre religion.*"

In the meantime the states of the American Union, and the other provinces of the Dominion of Canada, have to accept the fact that there still remain many centres of small-pox infection in Lower Canada—how many, I have tried to find out, but have not been able; further, that vaccination is but slowly making its way amongst the *habitans*, and that isolation in the parishes of small-pox cases is at best but imperfectly carried on, and that the central board's authority has been questioned, and in many other cases ignored. Its most recent efforts are being made towards the end of developing local action, by appointing inspectors, acting directly under the authority of the central board, to visit the different municipalities, and take such advisory or even legal measures as the exigencies of the case may demand.

While this French population does not to a very large extent travel frequently or far from home, still they go south to Vermont, Massachusetts, etc., north to the lumber woods, and through to Michigan; and, while it is not agreeable to think so, still our motto must be "*Semper poratus in armis (injicere).*"

The eastern provinces, as Prince Edward Island, Nova Scotia, and New Brunswick, may be considered as likely to organize and stamp out the disease, although it must be confessed that Charlottetown has been slow in getting to work. The new province of Manitoba has acted promptly in the present outbreak, and is prepared by inspectors to capture any stray cases which may pass west from Ontario, or north from Minnesota. The provincial government have appointed county medical health officers in all parts of the province, who are to be paid for whatever work they may have to do when a case of small-pox occurs.

From what has been stated, it is apparent that while in Canada a widespread epidemic has existed since last July, sanitary organization has been such as to arrest it after a determined struggle; and that with continued watchfulness in the *foci* of the disease at present existing, giving time for the dregs of the disease to be removed, the small-pox outbreak in Canada will have ended. That Ontario has been organized from the beginning of the Montreal outbreak has been made plain, while this is illustrated still better by the map before you, which shows all the places which have had cases of the disease. In none except Ottawa have the cases reached more than ten, and only three or four *foci* now exist in the province. Remembering Ontario's geographical and commercial proximity to Montreal, that three railway lines, the only ones running westward, and all the Ottawa and St. Lawrence navigation distributes to the province, I believe this association will agree,—when, under such conditions, not more than twenty places have had cases in six months; when in few of these did new cases spread from houses first infected; when in no instance were first cases due to imported merchandise or bag-

gage, and only one due, probably, to a letter; when to-day there are practically only two places having cases in points dangerous to the rest of the province; and when, so far as I know, no case has been transmitted by way of Ontario to adjoining states since the Ontario train inspection began,—that Ontario deserves the thanks of all those states contiguous to her for having kept small-pox away from them, and the thanks of this association for having instituted a system of internal quarantine, which, while it prevented small-pox outbreaks, did not prohibit all healthy commercial intercourse, and which, while it saved life, not only did not destroy, but actually supported, and in some degree restored, the trade of a great commercial city.

In view of these facts, which, by Dr. Rauch, the secretary of the State Board of Health of Illinois, Dr. Austin of the United States Marine Hospital Service, Consul-General Anderson, Dr. Watson, secretary New Hampshire State Board of Health, Dr. Young, secretary of State Board of Health of Maine, and Dr. Cook, inspector State Board of Health of New Hampshire, have been made known through the newspapers to the American people, and which have further been made the subject of official correspondence between the Dominion government and United States authorities since the middle of October last, I call upon this association, and appeal, not to its sympathies, but to its sense of common justice and ideas of enlightened sanitary work, to say whether a province which has maintained such a record for half a year should still continue to be treated as a menace to neighboring states, should still have an inspection regarding vaccination and luggage of her whole people kept up at Suspension bridge, should still have all luggage fumigated at the Detroit river, which, by an intelligent discrimination of Ontario officers, has been allowed to pass westward from Montreal unfumigated, and which, with probably not more than fifteen small-pox cases at the present moment in the whole province, has an embargo continued, which, in the eyes of the American commercial public, stigmatizes Ontario as an infected centre. We have for three years claimed sanitary kinship with this association, and through it with the people of the United States;—but what kind of kinship is it, I ask, which treats Ontario in the manner stated, while New York city, with twice as many cases, is not looked upon with any alarm?

Gentlemen of the association, I accuse no one, no state, no railway, nor any city, of taking any action which a prudent regard for their safety may at one time have deemed necessary; but I do say, that before such action was taken, common courtesy demanded that the views of the Ontario board regarding Ontario's condition and position should have been obtained by those demanding that such extreme measures, so arbitrary in their character, so imperfect in their execution, and so uncalled for in the face of facts patent to all inquiring, and known to very many prominent state and federal officers of the United States, should have been continued after repeated statements had been published, and when requests for removal had been made by a province so free from any accusations of existing disease, or neglect of precautions against its introduction within her own borders, or its transmission to any neighboring states.

XX.

PHYSICAL TRAINING IN GERMANY.

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For students of hygiene—particularly of school hygiene—the German system of physical training presents many highly interesting and suggestive features, since it is a system which has been brought within a hundred years to a high degree of efficiency through the combined efforts of idealistic and innovating thinkers on the one hand, and of severely practical administrators on the other. Its origin, development, and present organization all bear the impress of the peculiar national spirit of the German people. As this spirit has found its highest expression in the organization of the Prussian state, we may advantageously confine our attention in the main to a consideration of the peculiarities of physical training in Prussia.

In Prussia, as elsewhere throughout Germany, gymnastics, called "turning" by the Germans, play an important part in the education of youth, in the training of the soldier, and in the recreations of the people. The most eminent names in the history of German turning are those of Gutsmuths, Jahn, and Spiess, all of whom were teachers and reformers, and each of whom voiced in a peculiar way the spirit of his time. Gutsmuths, born in 1759, was identified with the philanthropists, a body of educational reformers, who, under the lead of Basedow Salzmann and Pestalozzi, in the last third of the eighteenth century, in their efforts to make education natural and harmonious, contended that the bodily training of children was a matter of fundamental importance. From 1785 till his death in 1839, Gutsmuths labored as a teacher in Salzmann's *Philanthropinum* at Schnepfenthal, near Gotha. By reason of his study of the ancient Greek and German games, his practical skill as a deviser and teacher of bodily exercises, and his ability as a writer, Gutsmuths did much to arouse an interest in gymnastics, to define their aims, and to indicate methods for teaching them. His most important work, "Gymnastics for Youth," appeared in 1793.

"Father Jahn," as the German turners delight to call him, lived from 1778 till 1852. He wrote much, both on political and educational topics, but his classic work, *Die Deutsche Turnkunst*, *i. e.*, German Gymnastics, was published in 1816. His life and labors reflect the stormy and troubled times of Prussia's greatest humiliation under Napoleon.

He strove to give gymnastics a national character, and to make them influential as a means to uniting the Germans into one nation, intellectually, morally, and physically strong against their enemies. The growth of the turner organization, in the period from 1811 when Jahn instituted the first turning-ground (*Turnplatz*) for the benefit of the boys of Berlin, till the war of liberation in 1813, was extraordinary. Men of all ages and classes became turners, and almost to a man took part in the rising against the French. Jahn invented what are commonly termed heavy gymnastics. Several of our best known gymnastic machines, such as the horizontal bar, the parallel bars, and the horse, date from his time. The members of the *Turnvereine* or gymnastic societies were divided into two classes, viz., men and boys, and were exercised in a great variety of feats, under the lead of their most expert gymnasts, who were called foreturners (*Vorturner*), in such a manner as to develop individual daring, hardihood, and self-confidence. A scheme for the general introduction of turning into the higher schools for boys was elaborated by the Prussian department of education in 1819. Owing to certain political disturbances in that year it did not receive the approval of the king, and therefore failed of adoption. Jahn was imprisoned for several years, and the *Turnvereine* were suppressed.

In 1842 King Frederick William IV declared, in a cabinet order, that gymnastic training was a necessary and indispensable constituent part of the education of boys, and should be adopted as a means of education of the people. In accordance with this order, gymnastics were gradually introduced into the higher schools for boys. In 1862 instruction in gymnastics was made obligatory in the lower public schools for boys throughout Prussia. Within a few years gymnastics have been made obligatory in girls' schools of all grades in certain cities,—*e. g.*, Berlin, Frankfort-on-the-Main, and Hanover.

Adolf Spiess, a Hessian, who died in 1858 at the age of forty-eight, did more than any other man to develop the German school turning into a practical, well ordered system. He was for many years a practical teacher of gymnastics in the Swiss cities of Burgdorf and Basel. During the last ten years of his life he organized and supervised gymnastic instruction in the schools, both for boys and girls, of the Grand Duchy of Hesse. He strove, in his *Lehre der Turnkunst*, Basel, 1840, and his *Turnbuch für Schulen*, Basel, 1846, to elaborate and illustrate the theory of bodily exercises as a department of school instruction. He laid especial stress upon such movements as could be executed without apparatus and in unison, by an entire school class, under the command of a teacher instead of under the lead of a foreturner. Exercises of this sort, termed free gymnastics (*Freiübungen*), were first devised by Spiess, who also reduced the heavy gymnastics of the Jahn school to a system of progressive, carefully ordered class exercises. The *Turnvereine* still follow the system of Jahn more closely than any other, while in school gymnastics the system of Spiess predominates. A great variety of games, known as *Turnspiele*, are utilized in the instruction of

the younger school children. Swimming and skating are largely encouraged; as are also pedestrian trips, both in term time and vacation, under the direction of the teachers of gymnastics. The boys in the highest classes of the higher schools are regularly taught fencing, in addition to heavy gymnastics. In passing, it should be noted that there are flourishing *Turnvereine* in most of the German universities, and that nearly every university, moreover, has a regularly appointed sword-master and riding-master.

While gymnastic drill is not universal in the public schools of Prussia, it is very general. In 1882 only 10 per cent. of the pupils in the higher schools were excused from turning, and they were excused on the certification by physicians that, on medical grounds, the exercise would be prejudicial. In 1881 there were more than 4,800,000 children of school age in a population of twenty-seven and a quarter millions in the kingdom of Prussia. The number of teachers was over 61,000. In 1880 the population of Berlin was 1,122,330. The total number of children in the schools of all kinds in Berlin in 1881 was 149,091. Of these over 125,000 were in public schools, not all of which are public in our sense of the word. There were, however, 104,726 children in schools maintained wholly at the expense of the city. Of seventy-one gymnasiums in our sense (*Turnanstalten* in German), nine were under royal patronage, and sixty-two belonged to the city. Of the total number, forty-one were also provided with special play-grounds. One of the above mentioned gymnasiums belonged to the city orphan asylum, another to an institution for the deaf and dumb, and a third to an asylum for the blind. The city or Berlin paid nearly $50,000 in 1880–1881 for the gymnastic instruction of its school children, which sum equals about one twenty-third of its total expenditure for schools in that year. In 1885 there were some 143,000 children provided with free instruction in the schools of Berlin, which means an increase of 10,000 over the same class of children in 1884.

The number of gymnasiums now maintained by the city of Berlin is ninety-eight. The largest of them was built in 1864, at a total expense of about $93,000, including the cost of a spacious play-ground adjoining it. The building consists of a main hall, which is 150 feet long, 75 feet wide, and 48 feet high, and two wings. Each wing contains three residence flats, for the use of the officials in charge of the gymnasium. Nearly 400 turners can be accommodated at one time in the hall. It is used every week-day by pupils of the schools, and on Sundays and every evening it is in use by various *Turnvereine*. Something more than 13,000 persons exercise in it weekly. In general the school gymnasiums in Berlin, as elsewhere in Prussia and throughout Germany, are separate and specially fitted structures. The German gymnasiums are not so luxuriously fitted or so architecturally imposing as many of the newest and finest of American college gymnasiums, but, as a rule, they are admirably fitted for the teaching of free and class gymnastics of every sort. As much as possible the apparatus is adjustable and portable.

In the Prussian *Lehrplan*, or curriculum of studies, two hours weekly are usually assigned for gymnastic instruction. The same number of hours are devoted to singing and to drawing. The total number of school hours in a week varies in different classes of schools from twenty to thirty-two. It is said that there are fully a thousand teachers in the Berlin schools who are competent to give instruction in gymnastics. In only a small number of cases do they teach gymnastics solely, the majority being teachers who have received normal training not only in gymnastics, but in the other branches of instruction as well.

No one is allowed to become a teacher of gymnastics in a Prussian school without a certificate of fitness from the Board of Examiners for Teachers of Turning (*Turnlehrer Prüfungs Kommission*) or from the Royal Training-School for Teachers of Turning (*Königliche Turnlehrer Bildungsanstalt*). The examinations for both classes of certificates are held at Berlin. The examinations set by the board for male candidates are held yearly in February, while those for female candidates take place every spring and autumn. The Royal Training-School provides two normal courses of instruction yearly (one for males in the autumn and winter, and one for females during the spring and summer), and holds examinations at the close of each course. In all examinations, which are of three kinds, written, oral, and practical, the aim is to test the knowledge of the candidate in regard to the fundamental laws of human anatomy and physiology, his familiarity with the salient facts in the history of turning and the peculiarities of the different systems of school turning, and his ability to perform and teach the principal exercises belonging to free and heavy gymnastics. As a rule, those who present themselves for examination by the board are teachers who have attended normal courses in turning in one of the principal cities. University and seminary students who propose to become teachers are also eligible for these examinations.

The *Turnlehrer Prüfungs Kommission* gave certificates of fitness to thirty-nine males in February, 1885, eight of whom were also pronounced fit to teach swimming. In November, 1884, forty-three females passed its examinations, and eighty-three more passed in May, 1885.

In the winter of 1884–'5 seventy-one men attended the normal course of the royal training-school, and were awarded its certificate of fitness to teach gymnastics. Forty-two of them received certificates of ability to teach swimming. The same institution issued eighty-two certificates of fitness to young women, who completed its course given during the months of April, May, and June, 1885. In addition to the regular course in gymnastics, twenty-eight of the eighty-two received instruction in swimming.

The Royal Training-School for Teachers of Turning at Berlin is open to all Prussians. Pupils from without the kingdom are admitted on compliance with certain conditions. This school was established in 1851. Until 1877 the training-school and the Central Military Institute for Turning were under a single head, and occupied the same premises. Parallel

normal courses for army officers and teachers in the schools were given during this period. The two institutions are now totally distinct from each other, and each has its separate establishment. Prof. Dr. Carl Euler, the accomplished head of the royal training-school, has been connected with it for the past twenty-four years. Prof. Euler is also the head of the *Turnlehrer Prüfungs Kommission*. Similar normal schools for training teachers of turning exist in all the principal states of the German empire. That at Dresden, for Saxony, dates from 1850. There is one at Stuttgart, for Wurtemberg, founded in 1862; one for Baden, at Karlsruhe, founded in 1869; and one at Munich, for Bavaria, founded in 1872.

The main features of the Prussian system of military training and discipline are so well known that we need not attempt to give a detailed account of them; but the training of the soldier is so largely a matter of physical training that it should not pass unnoticed in this connection. The laws of Prussia require every child between the ages of six and fourteen to attend school, and the school attendance is lengthened several years for all who aspire to anything beyond an elementary education. The majority of able-bodied men, on attaining the age of twenty, are liable to three years of continuous military service in time of peace. Speaking broadly, at this moment nearly twenty per cent. of the population of Prussia are to be found in its schools, one per cent. are serving in the army, and perhaps a third as many more are members of the *Turnvereine*, so that more than one fifth of the Prussian people under middle age are subjected to some sort of physical training. Gymnastic drill, both in free and heavy exercises, is as much a part of the military training of recruits as is the manual of arms. Moreover, the infantry soldier has more or less of gymnastic drill throughout his three years of service with the colors.

At the Central Military Institute for Turning, in Berlin, two courses of instruction are given yearly. Each course lasts for five months. The teachers of the theory and practice of military turning are all officers of the army especially detailed for this service. The pupils in each course usually number one hundred. They are mostly lieutenants picked from every branch of the line. The course is severely practical, and admirably fits them to give instruction in military gymnastics to the under officers and men of their respective regiments. The Prussian system of military gymnastics seems far preferable to that employed in the British army, as in the latter army the instruction is in the hands of non-commissioned, and therefore far less intelligent, officers.

The gymnastic societies termed *Turnvereine* constitute a popular and influential German institution. They are widely spread throughout the empire of Germany and Austria also. On the first of January, 1885, they numbered 3,207, and of these all but 329 belonged to a single organization, the *Deutsche Turnerschaft*, which dates from 1860. The total number of members, over fourteen years of age, belonging to the *Turnerschaft*, was, in 1885, 267,854, of whom 114,134 were set down as active turners. This was an increase of 24,481 over 1884. The number

of vereine which owned a gymnasium *(Turnhalle)* was 353, and 182 possessed an out-of-door gymnasium *(Turnplatz)*.

The *Turnvereine* hold frequent meetings and festivals, and play a prominent part in the celebration of national holidays, such as the emperor's birthday, the anniversary of the battle of Sedan, and the like. The turning festivals are as truly popular, in their way, as are the festivals of the shooting and singing societies. Since 1860, when the first general German turning festival was held at Coburg on the anniversary of the battle of Waterloo, similar festivals of the *Turnerschaft* have been held in Berlin in 1861, at Leipzig in 1863, at Bonn in 1872, at Frankfort-on-the-Main in 1880, and in Dresden in 1885. That at Berlin in 1861 was held to celebrate the fiftieth anniversary of the beginning of German turning in Jahn's *Turnplatz*, near Berlin. The corner-stone of the national monument to Jahn was laid on that occasion. At the Leipzig festival the *Turnerschaft* celebrated the fiftieth anniversary of the victory of the allies over Napoleon.

The Sixth General Turning Festival, held at Dresden, July 18 to 23, 1885, was held in commemoration of the founding of the *Turnerschaft* twenty-five years before. More than 20,000 turners took part in the Dresden festival. In the general free gymnastics on the 19th of July more than 4,500 turners exercised in unison. The programme also included turning by squads of the most proficient turners, who had been chosen to represent the different circuits, districts, and vereine into which the *Turnerschaft* is divided; exhibition and prize turning by individuals; gymnastic games *(Turnspiele)*, in which nearly 3,000 boys and girls from the public schools of Dresden participated; a torch dance; and contests in wrestling, fencing, and cut-and-thrust sword-play. As the weather was fine, all the gymnastic exercises and games took place out of doors. Speeches, singing, dancing, and merry-making enlivened the proceedings. Representatives of German gymnastic societies in the United States, England, and all the principal countries of continental Europe, were present at Dresden. The prizes awarded to the winners in the competitive exercises consisted of simple wreaths of artificial oak-leaves, and diplomas. Taken all in all, the festivals of the German turners resemble the ancient Grecian games more closely than do any others of our day.

It is interesting to note that gymnastics were introduced into the United States in the period 1825–1830 by Germans who had been pupils of Jahn; and that the principal association of turners in the United States, which is termed the North American *Turnerbund*, now numbers more than 21,000 members in more than two hundred *Turnvereine*. The *Turnerbund* maintains ninety-eight salaried and highly trained teachers of turning, and owns one hundred and forty gymnasiums. It maintains a normal school for training teachers of turning at Milwaukee. Jahn's son, who has lived at Baltimore for many years, receives an annual pension from the *Turnerbund*, which has adopted Jahn's grandson, who is now a member of the Milwaukee *Turnlehrer Seminar*, as its foster-child.

The *Turnerbund* has also established schools for the purpose of providing instruction in the German language and gymnastics. In 1885 more than 12,000 boys and more than 4,000 girls were enrolled in these schools.

The German system of physical training, in its three departments of school, military, and popular turning, seems to me to present numerous features that are worthy of study and adoption, if we really mean to check the present tendencies towards brain-forcing in the education of American youth. It is a system which has been developed by men actuated by patriotic and scientific aims. In comparison with it, British athletic sports are primitive, unsystematic, and rude, inasmuch as their ends and methods are essentially boyish, and in some respects only semi-civilized.

REPORT

OF THE

COMMITTEE ON DISINFECTANTS.

1885.

COMMITTEE.

GEORGE M. STERNBERG, M. D.,
Surgeon U. S. A.; Fellow by Courtesy in Johns Hopkins University.

JOSEPH H. RAYMOND, M. D.,
Commissioner of Health of the city of Brooklyn, N. Y.

CHARLES SMART, M. D.,
Surgeon U. S. A.; Member National Board of Health.

VICTOR C. VAUGHAN, M. D., PH. D.,
Member Michigan State Board of Health.

A. R. LEEDS, M. D.,
Member New Jersey State Board of Health.

W. H. WATKINS, M. D.,
Medical Director of the Auxiliary Sanitary Association of New Orleans.

GEORGE H. ROHÉ, M. D.,
Baltimore.

INTRODUCTORY.

GENERAL REPORT OF THE SECRETARY.

At the last annual meeting of the American Public Health Association, held in St. Louis, Mo., October 14–17, 1884, the following resolution was offered by Dr. James F. Hibberd, of Indiana, referred to the Executive Committee, and, after a favorable report by that committee, unanimously adopted by the Association:

WHEREAS, It is important, equally for practitioners of medicine, for boards of health, and for the general public, that the highest attainments of science in this department of sanitation should be formulated for easy reference by all who need it for practical application, and especially is this desirable in view of the probable visitation of cholera in the near future;—therefore be it

Resolved, by the American Public Health Association, That a committee be appointed to examine the subject of disinfectants, antiseptics, and germicides, in their relations to preventive medicine and sanitation, and that said committee formulate a table of these agents for the information of those interested, the agents to be classified, so far as may be deemed advisable, according to their specific virtues, facility of application, and economy of use.

In accordance with this resolution, the following committee was appointed by the president of the association:

Major George M. Sternberg, Surgeon U. S. Army, Fellow by Courtesy in the Johns Hopkins University, Baltimore; Dr. Joseph H. Raymond, Professor of Physiology and Sanitary Science in Long Island College Hospital, and health commissioner of the city of Brooklyn; Dr. Victor C. Vaughan, Professor of Physiological Chemistry in the University of Michigan, and member of the Michigan State Board of Health; Major Charles Smart, Surgeon U. S. army, and member of the National Board of Health; Dr. W. H. Watkins, Medical Director of the Auxiliary Sanitary Association of New Orleans; Dr. Albert R. Leeds, Professor of Chemistry in Stevens Institute of Technology, and member of the New Jersey State Board of Health; and Dr. George H. Rohé, Professor of Hygiene in the College of Physicians and Surgeons, Baltimore.

The committee met immediately after appointment, and organized by the election of Dr. Sternberg as chairman and Dr. Rohé as secretary.

In order to be enabled to make an extended experimental research, the committee, after consultation, decided to appeal to municipal and state boards of health, and to other sanitary organizations, for financial aid. Responses to this appeal were encouraging; and a statement of receipts and disbursements on account of this work is appended to this report.

At a meeting held in Baltimore on November 20, 1884, the committee

was divided into two sub-committees,—one, consisting of Drs. Sternberg, Smart, and Rohé, to examine the literature of disinfectants, and abstract and tabulate the results, and to investigate in an exact manner in the laboratory the relative germicidal value of the various substances used as disinfectants. The latter part of the inquiry was exclusively under the direction of Dr. Sternberg, the chairman of the committee, who was granted exceptional facilities for carrying on this work in the biological laboratory of the Johns Hopkins University. The committee would here take occasion to express to the trustees of the university its high appreciation of the courtesy and aid extended by them while these investigations were in progress.

The second sub-committee, consisting of Professors Raymond, Vaughan, and Leeds, and Dr. Watkins, was appointed especially to investigate the practical application of such disinfectants as are found efficient, upon a large scale, their cost, methods of use, chemical relations, effects upon furniture or fabrics, or their possibly poisonous effects upon human beings or animals.

Reports and papers from members of both of these committees will be found under the heading "Experimental Data" in the body of this report.

The therapeutic value of the various substances investigated does not properly come within the purview of the committee, and has consequently received no attention.

At the conference of state boards of health, which was held in Washington, December 11 and 12, 1884, a preliminary statement of the work then accomplished and contemplated was made; and in accordance with authority received from the executive committee of the American Public Health Association, a series of *preliminary reports* has been published during the present year, in a medical journal of wide circulation—the *Medical News*, of Philadelphia. To Messrs. Lea Bros. & Co., the publishers of the journal mentioned, the committee is indebted for substantial aid afforded in rendering the results of the committee's work promptly available to sanitarians and the public.

The compensation received for the papers published in the *Medical News* was kept as a separate fund to cover the cost of printing the report herewith submitted. A considerable deficiency has resulted, responsibility for which has been assumed by individual members of the committee.

George H. Rohé, *Secretary*.

FINANCIAL STATEMENT.

RECEIPTS.

From American Public Health Association,	$50.00
" H. Lomb, Esq.,	50.00
" W. G. Little, Esq.,	50.00
" Connecticut State Board of Health,	50.00
" Illinois " "	50.00
" Iowa " "	50.00
" Louisiana " "	25.00
" Massachusetts " "	50.00

From Michigan State Board of Health,	$50.00	
" New York " "	50.00	
" South Carolina " "	25.00	
" Wisconsin " "	25.00	
" Provincial Board of Health, Canada,	25.00	
" Boston " "	25.00	
" Brooklyn " "	100.00	
" Charleston " "	25.00	
" Pittsburgh " "	25.00	
" Sanitary Protection Association, Newport, R. I.,	10.00	
" Members of the committee,	12.15	
Total,		$747.15

EXPENDITURES.

Laboratory expenses,	$264.18	
Salary of assistants,	400.00	
Printing, binding, and mailing Preliminary Report, stationery, postage, express charges, and incidental expenses,	82.97	
Total,		$747.15

PRELIMINARY REMARKS BY THE CHAIRMAN OF THE COMMITTEE.

A complete investigation of both disinfectants and antiseptics being impracticable in the time and with the resources at command, the committee decided upon so far departing from the letter of the resolution under which it was appointed as to limit its investigations to the subject of disinfectants, properly so called, that is, to *those agents which are capable of destroying the infecting power of infectious material.*

In the experimental investigations made by the writer in the biological laboratory of Johns Hopkins University, the biological test of disinfecting power has been the only one employed. In applying this test a variety of micro-organisms have been subjected to the action of the various agents under trial, and the object in view has been to determine, within sufficiently narrow limits for practical purposes, the percentage in which these agents are capable of destroying the vitality of the test-organisms in a given time. This is determined by a series of experiments in which the agent being tested is used in a greater or less amount, according as it is found to fail, or to be effective. Failure is shown by the fact that the test-organisms grow in a suitable culture medium after having been exposed to the action of the disinfectant; on the other hand, failure to muitiply in such a solution is evidence that the test-organisms have been killed. Further details with reference to the method will be found in the paper on "Commercial Disinfectants," and also in my paper published in the *American Journal of Medical Science*, April, 1883, in which I give the results of an extended series of experiments of a similar nature.

Experiments of this kind rêquire a certain amount of technical skill, and a very great expenditure of time. Results which are recorded in a

single paragraph have often been reached only after making numerous experiments extending through days or even weeks.

It would of course be desirable to test each disinfecting agent upon a variety of pathogenic organisms; and there is no doubt that, within certain limits, differences in resisting power would be found. But this would be a task involving a still greater expenditure of time and money, and one which should follow the more general study which we have made.

The work already done is sufficient to justify the general statement, that *in the absence of spores, an agent which destroys the vitality of one micro-organism of the class to which known disease germs belong will destroy all other organisms of the same class*, although not necessarily in the same amount, or in the same time.

The fact that a certain agent destroys micrococci and bacilli without spores cannot, however, be taken as evidence that the same agent will destroy spores, for these reproductive bodies have a far greater resisting power; and certain chemical agents—*e. g.*, carbolic acid, sulphur dioxide—which are germicides, in comparatively small amounts, so far as micro-organisms in active growth are concerned, are quite impotent for the destruction of spores.

It has not been possible to make an exhaustive study of disinfectants, and the agents selected for experimental work have been chosen from a practical point of view, the object having been to fix as nearly as possible the value of those agents most relied upon by sanitarians for disinfecting purposes, and the conditions of successful disinfection with them.

George M. Sternberg, *Chairman.*

EXPERIMENTAL DATA.

COMMERCIAL DISINFECTANTS. NO. 1.

BY GEORGE M. STERNBERG.

In conducting the experimental investigations of the committee on disinfectants, the writer determined at the outset, in the interest of health officials and of the public, to ascertain the comparative values of the various commercial disinfectants in the market. In a recent paper by Wynter Blyth, medical officer of health for Marylebone, in which the commercial disinfectants, exhibited at the London Health Exhibition, are intelligently discussed, we find the following:

> Rampant rides the quack in the fields both of preventive and remedial art. Quackery takes a well known common powder, labels it with a grand mystic name, selling bright copper at the price of gold. Quackery finds a stink outstinking feebler stinks, and gives it forth as a disinfectant. Of all the substances gathered together under the name of disinfectants—solids, vapors, gases, and odors—a small percentage alone possess any value.[1]

[1]Med. Times and Gaz., London, Oct. 11, 1884.

This statement applies as well to many of the articles advertised as "disinfectants" in this country. But in justice to the manufacturers of these so-called disinfectants, we must say that many of them, which are of no use in the sense in which we use the term, are valuable as antiseptics or as deodorizers; and that there is good authority for calling a substance which will prevent putrefactive decomposition, or which will destroy bad odors, a disinfectant. Many chemists and physicians use the word in this sense; and this is the popular acceptation of the term both in this country and in Europe. We therefore cannot find fault with those manufacturers who see fit to use the word as synonymous with deodorizer or antiseptic; but we must caution the public that a disinfectant from this point of view does not necessarily destroy infectious material, and that the word is used by this committee in accordance with the definition given in the introduction to this report.

It has been proved that certain kinds of infectious material owe their infecting power to living micro-organisms, which in a general way are often spoken of as "germs." A disinfectant, therefore, which destroys this kind of infectious material may be called a *germicide*. If all infectious material owes its specific infecting power to the presence of living organisms, then, from our point of view, disinfectant and germicide are synonymous terms. But in the absence of satisfactory proof that such is the fact, we must consider the former term one of general application, while the latter is only applicable in those cases in which the infecting agent has been proved to be a germ. But in our tests of disinfectants we are obliged, for the most part, to depend upon experiments which determine germicide power, and in the experiments reported below, only biological tests have been used. As a matter of fact, those agents which by laboratory experiments have been proved to be the most potent germicides, have, by the experience of sanitarians, by tests upon vaccine virus, septicæmic blood, etc., been shown to be the most reliable disinfectants.

Evidently there can be no partial disinfection;—either the infecting power of the material to be disinfected is destroyed, or it is not. Where the object is to destroy disease germs in the sputum of patients with diphtheria, in the discharges of patients with typhoid fever, etc., so that no development shall occur when these germs find a proper nidus, incomplete destruction will be a waste of ammunition, for so rapid is the multiplication of these low organisms that the question of numbers is of secondary importance. It is therefore essential, in an experimental inquiry of this kind, that the most rigid tests may be applied, and that we keep on the safe side in the practical application of those agents which withstand these tests.

In our experiments below reported, the material which has served to test the germicide power of the agents named is "broken-down" beef tea, exposed in the laboratory for several days, and containing a variety of putrefactive bacteria and their spores. The spores of *Bacillus subtilis* are also invariably present in this stock; and when a certain agent is suc-

cessful in destroying all other micro-organisms, we frequently have in our culture-solutions a pure culture of this bacillus, which is noted for its abundant and wide distribution, and for the great resisting power of its spores. In order to meet the objection of those who are likely to cavil because no "disease germs" are present in the material mentioned, a culture of *Bacillus anthracis* containing spores is added to this stock solution. It is well known that anthrax spores constitute one of the most difficult tests of germicide power,—not more difficult, however, than the spores of *B. subtilis*. We may safely assume, then, that an agent which will destroy these spores will also destroy all known disease germs, and probably all organisms of this class, known or unknown. The micrococci and bacilli, not containing spores, are far more easily destroyed.

The time of exposure to the disinfecting agent in all of these experiments has been two hours. And the amount of material to be disinfected has, in every case, been made equal to the amount of the solution of the disinfecting agent under trial. Thus, to test an agent in the proportion of fifty per cent., a certain quantity—10 cc.—of the agent undiluted (100 per cent.) is added to an equal quantity of the broken-down beef stock described. If we wish to test the agent in the proportion of four per cent., an eight per cent. solution is made, and this is added to an equal quantity of the stock, etc. The mixture is placed in a wide-mouthed bottle containing 25 cc., and is set aside for two hours. A minute quantity of the material is then introduced into two little culture-flasks[1] (all experiments are made in duplicate) containing sterilized beef tea, and these are placed in the oven, which is kept constantly at a temperature of 36° to 38° C. (96.8° to 100.4° F.) My method has been explained in detail in a paper relating to an extended series of experiments of a similar nature, published in the *American Journal of the Medical Sciences*, for April, 1883.

These experiments on commercial disinfectants have been very carefully made, under my direction, by Dr. Duggan. The samples were, for the most part, obtained for me by Dr. Raymond, health commissioner of Brooklyn, and a member of the committee, in the cities of New York and Brooklyn. As the experiments are made in the interests of the public, special pains have been taken to secure samples such as are placed in the market; and the rule was adopted at the outset not to test samples sent to us by the manufacturers, but to purchase ourselves such packages as are offered for sale by druggists and other dealers.

Numerous experiments were made, but only those are recorded here which fix the limits between success and failure. In four instances, a failure occurred in the proportion of 50 per cent., *i. e.*, when the undiluted solution was added to an equal quantity of the test material. These agents were at once dropped without further trial. In the table, the agents are arranged with reference to their relative efficiency.

[1]The flasks used are all made in the laboratory, and are of the form described in the chapter on technology in my book, "Bacteria."

LIST OF COMMERCIAL DISINFECTANTS TESTED.

Name upon Label.	Per cent. in which active.	Per cent. in which failed.
Little's Soluble Phenyle (Morris, Little & Co., Brooklyn), . .	2	1
Labarraque's Solution (*Liq. sodæ chlorinatæ*); name of manufacturer not given, ...	7	5
Liquor Zinci Chloridi (Squibb's), ...	10	7
Feuchtwanger's Disinfectant (L. Feuchtwanger & Co., New York), ...	10	8
Labarraque's Solution (From Freré, Paris), ...	15	10
Phenol Sodique (Hance Bros. & White, Philadelphia), . . .	15	10
Platt's Chlorides (Henry B. Platt, New York), ...	20	15
Girondin Disinfectant (James Meyer, Jr., New York), . . .	25	15
Williamson's Sanitary Fluid (D. D. Williamson, New York),	25	20
Bromo-chloralum (Bromo-Chemical Co., New York), . . .	25	20
Blackman Disinfectant (Blackman Disinfectant Co., New York), ...	30	20
Squibb's Solution of Impure Carbolic Acid (about 2 per cent.),		50
Burchardt's Disinfectant (J. H. Harty & Co., New York,)		50
Phenol Sodique (7 Rue Coq. Héron, Paris), ...		50
Listerine (Lambert & Co., St. Louis), ...		50

I append to this list the report made by Wynter Blyth (*loc. cit.*) upon certain commercial disinfectants exhibited at the London Health Exhibition:

Various Tar-Acid Disinfectants. Jeyes's perfect purifier, the concentrated carbolated creosote of Messrs. D. & W. Gibb, the kresylene described by Messrs. Mackay & Co. as a preparation of coal-tar creosote, pixene, and the thymo-cresol exhibited by Messrs. Ness & Co., have all the property of emulsifying with water. Jeyes's purifier was for some time tried in St. Marylebone urinals and drains, but the deposit left on the surface with which it had been in contact was found difficult to cleanse, and inconvenient. I have made some experiments on anthrax in the spore state with the "perfect purifier." The solutions used were 5 to 10 per cent.; the "fluff" had to be freed from the tenacious fawn-colored deposit by alcohol. The result was very similar to what might have been predicted from results of experiments on the pure tar-acids, viz., growth was a little delayed, but never destroyed.

Mr. James Wheeler's pixene I was, on the whole, favorably impressed with. He claims to have condensed the whole of the volatile constituents of pure tar, and to have presented them in a form readily miscible with water. * * * Anthrax spores soaked in a ten per cent. solution did not grow for some time.

Carbolic Acid Powders. I have experimented on anthrax with Calvert's, Jeyes's, and McDougall's powders; but, even when a paste was made with the several powders, and the infected "fluff" allowed to remain therein twenty-four hours, no sterilization resulted.

Similar powders were obtained by our committee in New York and Brooklyn, but I have not thought it worth while to make any experiments with them, as sawdust or other material, saturated with impure carbolic acid or with the volatile constituents of tar, can have no great value in view of the low disinfecting power of these agents minus the sawdust. An agent which has gained considerable reputation in England is referred to as follows by Blyth:

Sanitas. Of all the substances introduced under the name of disinfectant, this is the most pleasant. Sanitas is chiefly in the form of sanitas oil and sanitas fluid: peroxide of

hydrogen, thymol, camphoric acid, and terebene enter into their composition. Of the numerous sanitas preparations, liquid and solid, the oil seems to be the most active. Nothing replaces or destroys so rapidly the unpleasant odor which tenaciously adheres to hands contaminated by offensive animal matters. It is also to be commended for use in stables, and as a corrective for dung-heaps, and of the sickly smell at times rising from the metropolitan wood pavement. I made many experiments with sanitas on anthrax. Spores soaked in sanitas fluid for twenty-four hours grew afterwards very freely. Spores placed in the undiluted emulsion, and afterwards removed, seemed at first to have their growth delayed; but in forty-eight hours growth commenced, and ultimately became luxuriant. The oil itself gave similar results. Sanitas powder was also tried, but with no better success.

Returning to the disinfectants in our list, it will be seen that all but the four last named are efficient in various amounts, ranging from 30 to 2 per cent. But the relative value of the agents as here given does not establish their comparative practical value as disinfectants. Questions of cost, physical and chemical properties, etc., come into the account, which it is the province of other members of our committee to consider.

We have nothing to say against the use of any of the agents in our lists as antiseptics or as deodorizers. No doubt all of them are more or less useful for this purpose, and we have no desire to restrict their use. But the exaggerated claims made in relation to the germicide or disinfectant power of certain of these agents, may do immense harm. Thus, one agent advertised as a "germicide" *par excellence*, "Pasteur's marvellous disinfectant," which failed *after two hours' exposure* to kill the organisms in our test solution in the proportion of 20 per cent. Yet this fluid is, by some contrivance, to be thrown into the water-closet of every germ-fearing citizen when he pulls the handle, so that it may catch the germs on the fly, and extinguish their power for mischief before they reach the sewers. On the whole, the proprietary disinfectants have turned out better than I anticipated; and any one of the eleven first named may be used in conformity with the conditions imposed by the experimental test for disinfecting sputum or excreta. For fecal matter, however, it will be best to employ an agent which is successful in the proportion of ten per cent.,—for example, in at least twice this strength, and in quantity considerably in excess of the material to be disinfected. It must be remembered, that in our experiments the germs are suspended in a fluid, and this is thoroughly mixed with the disinfectant.

The second agent in our list is the well known *liquor sodæ chlorinatæ*.

Our experiments lead me to think that this time-honored disinfectant is worthy of more attention than it receives to-day, when so many other agents of inferior value are being pushed by enterprising manufacturers. Our two samples differ greatly in their disinfecting power, which depends upon the amount of sodium hypochlorite present. Dr. Duggan has prepared and experimented with a solution containing six per cent. of available chlorine, which proves to be efficient in the proportion of one per cent. I am informed that a solution containing two per cent. of available chlorine could be put in the market for less than forty cents per gallon. Whether this is to be the disinfectant with which we shall fight

cholera must be determined by my colleagues, who take up the question from a practical standpoint. But whatever agents are determined to be the best, must be so cheap that they may be obtained by the gallon, and used without stint. The time has passed when *pater familias* can complacently congratulate himself upon having disinfected his house with a bottle of carbolic acid, which he has brought in his vest pocket from the corner drug store.

In view of the efficiency and cheapness of the hypochlorites, I have requested Dr. Duggan to give special attention to these agents, and to prepare a report, embodying the results of his biological tests, and such information relating to the *modus operandi*, chemical characters, and available tests of strength, as may be useful to health officers and to the public.

GERMICIDE POWER OF THE HYPOCHLORITES.

BY J. R. DUGGAN, M. D., PH. D.

In my previous work on commercial disinfectants, I found that the specimens of Labarraque's solution of sodium hypochlorite, although containing only a small quantity of this salt, were among the most effective in their action. On looking over the literature of the subject, I found that although this solution and that of the corresponding calcium salt (chloride of lime) were among the first used disinfectants, very little had been done to fix accurately their value. In order to determine this, I prepared standard solutions of sodium and calcium hypochlorites for use in the following experiments. The available chlorine, that is, the chlorine which enters into the constitution of the hypochlorites, was determined in these solutions by its oxidizing action on a standard solution of arsenious acid,—papers saturated with starch paste and potassium iodide being used to show an excess of the hypochlorite. The well known method of Dr. Sternberg was used throughout the investigation to determine germicidal value. The following solutions were prepared:

Solution A. Sodium hypochlorite made by passing chlorine gas into a solution of sodium hydroxide. Available chlorine = 6 per cent.

Solution B. Calcium hypochlorite made by passing chlorine gas into milk of lime. Available chlorine = 6 per cent.

Solution C. Calcium hypochlorite made by dissolving 100 grammes of bleaching powder (chloride of lime) in 1 litre of water, and filtering. Available chlorine = 2.4 per cent.

Solution D. Potassium hypochlorite made by passing chlorine gas into a solution of potassium hydroxide, and diluting until the available chlorine = 1 per cent.

The action of Solution A on spores of *Bacillus anthracis* was tried with the following result: 2 per cent. was effective in 30 minutes, 1 hour, and 2 hours; 1 per cent. failed in 1 hour, effective in 2 hours.

Solution B in 2 per cent. gave similar results. In 1 per cent. it was effective in both 1 and 2 hours.

Solutions A and B were both found to be effective in 5 per cent. and 1 minute's time on the organisms of broken-down beef tea. One half per cent. of these solutions failed to destroy in 2 hours organisms in broken-down beef tea, but 1 per cent. of Solution A was effective in the same time. One of the bulbs from a 1 per cent. solution of Solution B broke down, but the other remained clear. These solutions were also tried in 2 and 3 per cent. for 2 hours, and found effective.

Solution C was effective in 3 per cent., but failed in 1 and 2 per cent. in 2 hours.

Solution D was effective in 7 per cent., but failed in 5 and 6 per cent. in 2 hours.

In addition to these, we may mention a dilute solution of bleaching-powder of unknown manufacture. This contained .4 per cent. available chlorine, and was effective in 15 per cent., failed in 10 per cent.; time, 2 hours. The commercial specimens of Labarraque's solution, reported among the commercial disinfectants, showed about the same value in proportion to the available chlorine they contained. These latter experiments were all made on broken-down beef tea. That this contained spores as well as organisms was shown by the fact that tubes inoculated from the solution while boiling developed various bacilli. Of course, spores must have been present to resist this temperature.

While it has been thought well to use a pathogenic organism in some of these experiments, I am convinced, from recent works on the subject, that any agent that will destroy *Bacillus subtilis* will also destroy *B. anthracis*, and probably any other pathogenic organism.

The foregoing experiments show that a solution containing .25 of 1 per cent. (1 part to 400) of chlorine, as hypochlorite, is an effective germicide, even when allowed to act for only one or two minutes, while .06 of 1 per cent. (6 parts to 10,000) will kill spores of *B. anthracis* and *B. subtilis* in two hours. A simple calculation will show that all the solutions used were effective when diluted to about this strength, and failed a little below it. No better evidence could be had of the reliability of the excellent method of Dr. Sternberg for testing agents of this kind. These experiments were all made in duplicate, and they show a concordance which I am satisfied can be obtained by no other method with which I am acquainted.

The value of the various commercial preparations, such as Labarraque's solution and bleaching-powder (chloride of lime), of course depends on the amount of available chlorine they contain, since the chlorides and chlorates are of very little value as disinfectants. Bleaching-powder usually contains from 25 to 40 per cent. of available chlorine. For most purposes a solution containing 1 part of this preparation to 100 of water is strong enough, for this will contain from .25 to .40 of 1 per cent. of chlorine as hypochlorite. As is stated above, the smaller of these quantities is sufficient to destroy spores almost instantly. There

are very few purposes to which disinfectants are applied that are not fulfilled by this solution of 1 to 100 of bleaching-powder. It is not poisonous, does not injure clothing, bedding, etc., and is almost without cost, since bleaching-powder is worth only about five cents per pound. The sodium salt furnishes in some respects a more elegant preparation, since it leaves on evaporation sodium chloride, instead of the hygroscopic calcium chloride. If prepared according to the U. S. P., it does not keep very well; but when made by passing chlorine gas into a solution of an excess of caustic soda, it shows very little tendency to undergo decomposition.

Solution A, although rather concentrated, and frequently exposed to the light and air, has kept for a month without any appreciable change. A solution like this might be put on the market at a very reasonable price, and as it should be diluted with 20 parts of water, it would be far cheaper and more effective than any of the proprietary disinfectants. The odor of the hypochlorites is a slight objection to their use, but in dilute solution this is scarcely disagreeable. Where the odor is not to be regarded, the hypochlorous acid may be liberated by the addition of any common acid, thus increasing the oxidizing power, and liberating a most effective gaseous disinfectant. I hope to make further experiments on this point at an early day.

To fix the value of solutions of the hypochlorites, the following method is sufficiently accurate for ordinary purposes: A standard solution of potassium arsenite may be made by diluting seven parts of Fowler's solution with one and a half parts of water. This corresponds to a ½ per cent. solution of available chlorine. To apply the method, a given volume of the hypochlorite solution is measured out, and the arsenite solution added in small quantities. Between each addition the mixture is well stirred, and a drop taken out on a glass rod, and tested on a strip of paper saturated with iodide of potassium and starch paste, and dried. So long as any hypochlorite is present, the blue iodide of starch is formed; but when it has all been used up in converting the arsenite into an arseniate, the paper will remain colorless. As each volume of the potassium arsenite solution required for this corresponds to ½ per cent. of available chlorine, the calculation is very simple; *e. g.*, if one volume of the hypochlorite solution = 4.6 volumes of the arsenite solution, the amount of available chlorine present would correspond to 2.3 per cent. Since the preparations now on the market vary so much in the amount of chlorine they contain, this test should always be used to determine their value, and the amount of dilution required. Where the disinfectant is further diluted in use by being added to liquids or semi-solids, the original dilution should not be so great.

The hypochlorites possess the advantage over many of the metallic salts of not forming a coating of insoluble albuminoid matter around the solid or semi-solid masses, and thus protecting them from further action. On the contrary, when used in moderately strong solution they oxidize and disintegrate these materials. They are at the same time destroyed

themselves in the reaction, so that we are rid of germs, organic matter, and disinfectant all at the same time.

NOTE. The fact that the oxidizing disinfectants are destroyed in the reaction to which their disinfecting power is due, makes it necessary to use them in excess of the amount of organic material to be destroyed, otherwise germs included in masses of material not acted upon would be left intact in a fluid which is no longer of any value for their destruction; and as a few germs may be as potent for mischief as a large number, there would be a complete failure to accomplish the object in view. For this reason, the metallic salts, such as mercuric chloride, which are not destroyed by contact with organic material, have a superior value for the disinfection of masses of material left *in situ*, such as the contents of privy vaults and cesspools. In this case, even if germs enclosed in an envelope of the albuminate of mercury escape destruction, they will be prevented from doing mischief so long as they are included in such an envelope, and the wonderful antiseptic power of the agent used will prevent any development, probably for a sufficient length of time to insure the complete loss of vitality of any pathogenic organisms present.

GEORGE M. STERNBERG.

COMMERCIAL DISINFECTANTS. No. 2.

BY GEORGE M. STERNBERG.

The following named "disinfectants" have been tested, under my direction, by my efficient laboratory assistant, Dr. A. C. Abbott, of Baltimore. The test in every case has been made upon "broken-down" beef tea, by the method heretofore described in detail.

Several of the disinfectants which stand at the head of the list contain the potent germicide, mercuric chloride, as shown by the simple test of introducing a polished piece of copper into the solution. A deposit of metallic mercury upon the surface of the copper shows at once the presence of a soluble salt of this metal. Those who have occasion to use disinfectants, the exact composition of which is not made public, will do well to bear this in mind, and to remember, also, that the germicide power of such solutions is neutralized by contact with lead, copper, or tin, and that lead pipes are injured by passing through them solutions of corrosive sublimate in any considerable quantity.

Name upon label.	Per cent. in which active.	Per cent. in which failed.
Dr. Martin's "Disinfectant No. 1" (contains mercuric chloride)	2	1
"Thymo-cresol," English preparation, name of proprietor not given	2	1
"Withers's Antizymotic Solution" (contains mercuric chloride)	4	2
"Pasteur's Marvellous Disinfectant,"[1] Blackman Disinfectant Co., of New York (contains mercuric chloride)	4	2
"Purity," Egyptian Chemical Co., Boston	40	20
"King Disinfectant," Humiston Manufacturing Co., New Haven, Conn.		50
"Sanguantræ," P. W. Manning, Stoneham, Mass.,		50
"Phenoline," Hance Bros. & White, Philadelphia		50
"Golden Purifier," Thomas & Thompson, Baltimore		50

[1] A preparation bearing the same name, reported upon in previous report upon commercial disinfectants, did not contain mercuric chloride, and failed at 20 per cent.

Name upon label.	Per cent. in which active.	Per cent. in which failed.
"Smith's Odorless Disinfectant," the Louis Smith Co., New York		50
"Disinfecting Powder," G. L. Kidwell, Georgetown, D. C.		50
"Thymo-cresol Powder," English preparation, name of proprietor not given		50
"Chloridium," Chemical Vaporizer and Deodorizer Co., of New York		50
"Carbolcrystal Disinfectant," H. H. Childs, proprietor		50

Dr. Abbott has also tested for me the different preparations of chloride of lime, and of Labarraque's solution, which we have been able to obtain in the Baltimore market, with the following result:

CHLORIDE OF LIME.	Per cent. of available chlorine.
Brookman Manufacturing Co., Chicago	33.50
Risley & Co., New York	28.40
Rock Hill Alkali Co., Liverpool	28.00
Clagett Bros.	24.10

LABARRAQUE'S SOLUTION (LIQUOR SODÆ CHLORINATÆ).

Reed & Carnrick, New York	3.80
Parke, Davis & Co., Detroit, Mich.	2.75
Powers & Weightman, Philadelphia	2.62
Hance Bros. & White, Philadelphia	0.35
Alonzo L. Thompson, Baltimore	0.013

NOTES.[1]

BY THE CHAIRMAN OF THE COMMITTEE.

My attention has just been called to an advertisement of "Withers's Antizymotic Solution," in which it is stated that it is endorsed as the best by George M. Sternberg, M. D., Surgeon U. S. A.

I have never authorized the use of my name in connection with this or any other proprietary disinfectant. The only reference I have ever made to "Withers's Antizymotic Solution" is in the report on "Commercial Disinfectants," No. 2,[2] published in the *Medical News* of June 13th, where this has the *third* place in a list of fourteen commercial disinfectants, tested under my direction by Dr. Abbott. The remark is made, "Contains mercuric chloride." As a simple solution of mercuric chloride of 1 : 500 would be quite as efficient as a 4 per cent. solution of this disinfectant, the extravagant claims made for it are without foundation. The assertion that it is endorsed by me "as the best" is untrue.

Labarraque's Solution. I have received the following letter from a well known and reputable firm of manufacturing chemists:

[1] *Medical News*, Sept. 5, 1885.

[2] See ante, p. 202.

In the *Medical News* (Philadelphia) for June 13th we find a continuation of the Preliminary Report of the Committee on Disinfectants, including a report on the relative percentage of available chlorine in samples of different manufacturers of Labarraque's Solution. As you are doubtless aware, Labarraque's Solution is a very unstable preparation; and, although made with every possible care, will surely deteriorate by age. With such an article it is manifestly unfair to institute comparisons between different makers, without regard to the freshness, or otherwise, of the samples. To the unthinking reader, the bald statement that one preparation contains 3.8 per cent., and another only .013 per cent., is calculated to convey the impression that the preparation which contained so small a percentage has been improperly made (while really, when fresh, its percentage might have been greater than the highest named); and such an impression would naturally create a prejudice against the manufacturer, and, unfortunately, not be limited to the particular article mentioned.

I recognize the fact that the unthinking reader might make an inference unfair to the manufacturer, from the perusal of a "bald statement" such as is published in the table on page 659 of the *News*. I regret this, and will in future gladly give the date of manufacture, if the manufacturers will stamp it upon the bottle. As I propose to obtain new samples from time to time, and to publish the results of tests as to available chlorine, it may happen that the aggrieved manufacturers in this instance will come out at the head of the list next time. But these tests are made especially in the interests of the public, which, from my point of view, are superior to those of the manufacturers; and it is evident that great harm might result from reliance upon the disinfecting power of a liquid labelled "Labarraque's Solution," which contained only .013 per cent. of available chlorine. The fact that it was of full strength when first manufactured does not add to its value as a disinfectant for the excreta of a patient with cholera or typhoid fever. If the manufacturers will stamp the date of manufacture upon the label attached to each bottle, I will publish it, in future, it connection with the result of the tests to determine available chlorine present in the solution.

POTASSIUM PERMANGANATE.

BY GEORGE M. STERNBERG.

In my experiments made in Baltimore in 1881[1] it was found that a 2 per cent. solution of potassium permanganate was required to destroy the virulence of septicæmic blood, the test of disinfection being inoculation into healthy rabbits. In experiments made in San Francisco in 1883[2] it was found that .12 per cent. (=1 : 833) destroyed the micrococcus of pus in culture solutions. As the virulence of the blood in the first experiments was demonstrated to be due to the presence of a micrococcus which has, as a rule, less resisting power for chemical agents than has the micrococcus used in the second series of experiments, it

[1] "Bulletin National Board of Health," July 23, 1881: also, "Studies from Biological Laboratory of Johns Hopkins University," vol. ii, No. 2.

[2] *Am. Journal of the Medical Sciences*, April, 1883.

may be thought that these results are contradictory. This is not, however, the case, and the wide difference as to the quantity of the disinfecting agent required in the two series of experiments depends upon an essential difference in the nature of the fluid in which the germs to be destroyed were contained. The large amount of organic material present in the blood as compared with that in the culture fluid used in the second series of experiments fully accounts for the difference, for the disinfecting agent is itself quickly destroyed by contact with organic matter; and, indeed, its disinfecting power depends upon this instability of composition, and upon the oxidation of organic material with which it comes in contact.

This difference in the result, due to a difference in the amount of organic matter present in the material to be disinfected, is further exemplified in the following experiments:

November 26, 1884, a single drop of a pure culture of micrococcus of pus was subjected to the action of potassium permanganate for two hours, in the proportion of 1 part to 500, and in the proportion of 1 part to 1,000. Four culture-tubes containing a sterilized solution of beef-peptone were inoculated with the micrococci thus exposed (it is my practice to make every experiment in duplicate), and were placed in a culture-oven maintained at 38° C. (100.4° F.) for forty-eight hours. No development occurred in either of the tubes.

On the 29th of November a similar experiment was made with a culture solution containing both micrococci and bacilli. In this experiment there was no development of the micrococci, but the bacilli developed abundantly after exposure to the 1 : 1000 solution. No development of bacilli (*B. subtilis*) occurred, however, after exposure to 1 part in 250. In these experiments the permanganate, although in dilute solution, was not neutralized by the small amount of organic material contained in the drop of the culture fluid exposed to the action of the germicide agent. In the following experiments the conditions were varied, and a larger proportion of the permanganate failed to exert any germicide power.

November 24 equal parts of a .4 per cent. solution (1 : 250) of potassium permanganate and of "broken-down" beef tea were mixed in a germ-proof receptacle, and allowed to stand for two hours. Two culture-tubes were then inoculated with a minute drop of the mixture, and were placed in the oven. At the end of twenty-four hours an abundant development of putrefactive bacteria had taken place. In this experiment, then, we have a failure in the proportion of 1 : 500, but the experiment does not in the least invalidate those previously reported. The truth is, that in making the above mixture the permanganate is almost instantly decomposed by the excess of organic matter, while in the experiments in which a single drop of culture-fluid containing micrococci was introduced into a more dilute solution, there was still an excess of the permanganate, as shown by the color of the solution at the end of two hours. Having determined the germicide power of the permanganate

for micrococci, at least for one species of *micrococcus*, I desired to know whether the oxidizing power of this reagent, when present in excess, would destroy the spores of anthrax, which are recognized as furnishing one of the most difficult tests of germicide power. The following experiments have been recently made:

November 24 a drop of culture fluid containing an abundance of anthrax spores, a pure culture, was added to a considerable quantity of a .4 per cent. (1 : 250) solution of potassium permanganate. After two hours two culture-tubes were inoculated with a minute quantity of this material. These tubes were placed in the culture-oven, and the following morning contained an abundance of anthrax bacilli.

November 27 the above experiment was repeated, except that the time of exposure was extended to four hours. Again there was an abundant development of anthrax bacilli in the culture-tubes, showing that the spores had resisted; but in one tube the development was delayed, and it was only on the morning of the second day that flocculi of *bacillus anthracis* commenced to appear.

December 2 the experiment was repeated, with the exception that the time of exposure was extended to four days. The bacillus now failed entirely to develop in the culture-tubes, showing that the spores had been killed by this long exposure.

It is probable that in experiments in which the permanganate is present in excess, the amount present is of less importance than the time of exposure, and that a stronger solution would fail to destroy anthrax spores in a considerably shorter time. The resisting power of anthrax spores to this reagent is shown by these experiments to be greater than that of the spores of *B. subtilis.* This is true also of chloride of zinc, and no doubt of certain other chemical agents. On the other hand, the spores of *B. subtilis* have a greater resisting power for heat. These differences in resisting power show that it will be necessary to exercise due caution in applying the data obtained in experiments upon one pathogenic organism in our practical efforts to disinfect material containing a different organism.

According to Arloing, Cornevin, and Thomas, a 5 per cent. solution destroys the fresh virus of symptomatic anthrax, but has no effect upon the dried virus.

One per cent. was found by Koch not to destroy the spores of anthrax, but in the proportion of 1 : 3000 the development of these spores was retarded.

The experiments of De la Croix, like those of Miquel, have reference especially to the antiseptic power of the agents tested by him. He makes the statement, however, that one part of potassium permanganate in thirty-five kills the bacteria of broken-down beef tea. This statement is no doubt true under the conditions of his experiment; but, as I have shown, the result depends upon the time of exposure and the amount of organic matter present quite as much as upon the proportionate amount of permanganate with reference to the quantity of fluid operated upon.

If we add one gramme of permanganate to a litre of broked-down beef stock, it is quickly decomposed, and no germicide effect is produced; but if we add one drop of putrid beef tea to a litre of distilled water containing one gramme of permanganate, the organic matter, and the germs as well, contained in this drop of fluid are quickly destroyed by oxidation.

Several English investigators—Notter,[1] Calvert,[2] and Tripe[3]—have attempted to determine the value of potassium permanganate as a "disinfectant;" but the methods employed have not been such as could give satisfactory and definite results, although these earlier experiments demonstrated the value of this agent as an antiseptic and deodorizer.

Other English investigators—Baxter,[4] Braidwood, and Vacher[5]—have adopted a different test, and their results are interesting and valuable.

These gentlemen operated upon vaccine lymph, and the test of disinfection was the failure of this lymph to produce characteristic vesicles upon the arms of children not previously vaccinated. Comparative experiments were made in each case with lymph not subjected to the action of the disinfectant.

In Baxter's experiments 1 part in 200 was successful in destroying the specific virulence of vaccine lymph; and in those of Braidwood and Vacher a like result was obtained by adding two drops of a solution of 1 : 120 to "a tube of lymph."

From what has been said, it is evident that while potassium permanganate has decided germicide and antiseptic power, it is not generally applicable for purposes of disinfection, because of the readiness with which it is decomposed by organic matter. It is, however, a prompt and valuable deodorizer.

HYDROGEN PEROXIDE.

BY GEORGE M. STERNBERG.

Since Angus Smith, in 1869, proclaimed his belief that peroxide of hydrogen was to be the disinfectant of the future, sanitarians have been waiting for chemists to devise some method by which this agent may be manufactured at a sufficiently low price to bring it into general use. The absence of any corrosive or poisonous properties, or of any objectionable odor, and the promptness with which this agent destroys volatile putrefactive products and arrests putrefactive decomposition, seemed to make it the disinfectant *par excellence*. But we no longer accept the arrest of putrefactive decomposition or the destruction of bad odors as

[1] Dr. J. Lane Notter, "Dublin Journal of Medical Sciences," vol. lxviii (1879), p. 196.

[2] Dr. Grace Calvert, "Chemical News," London, vol. xxii (1870), p. 281.

[3] Dr. John W. Tripe, "Sanitary Record," London, vol. ii (1881), p. 201.

[4] Dr. E. B. Baxter, "Report on the Experimental Study of Certain Disinfectants." "Report Medical Officer Privy Council," etc., N. S. No. vi (1875), p. 216.

[5] "British Medical Journal," London, vol. ii (1876).

evidence of disinfecting power, and the question which here concerns us relates to the power of this agent to destroy germs.

The following experiments have been made by Dr. Duggan and myself with a solution of hydrogen peroxide prepared under the direction of Prof. Albert R. Leeds, a member of the Committee on Disinfectants. When first received from Dr. Leeds this solution contained 4.8 per cent. of H_2O_2, and 5 per cent. of sulphuric acid. At the expiration of a month the amount of hydrogen peroxide was again estimated by Dr. Duggan, and was found to be 3.98 per cent. Five weeks later the proportion was reduced to 2.4 per cent. The constant escape of oxygen at the temperature of the laboratory is shown by a continuous flow of minute bubbles from the interior of the liquid to its surface. Tested upon broken-down beef tea, when the proportion of H_2O_2 was 3.98 per cent. (say 4 per cent.), the solution was found to be active in the proportion of 30 per cent., while it failed in the proportion of 20 per cent.; that is to say, 1.2 per cent. of H_2O_2 in two hours' time destroyed all the organisms present in the broken-down beef stock, and .8 per cent. failed to do so. Tested upon a pure culture of *B. anthracis* containing spores, the same solution was effective in 20 per cent. (.8 per cent. $H_2O_2 = 1:125$), and failed in 10 per cent. Tested upon a pure culture of a micrococcus, obtained from a drop of blood drawn from the inflamed area in a case of vaccinal erysipelas, the same solution was effective in the proportion of 10 per cent. (.4 per cent. of $H_2O_2 = 1:250$), and failed at 5 per cent. In experiments made at a later date (March 28), when the strength of the solution was reduced to 2.4 per cent., *micrococcus tetragenus* was destroyed by 10 per cent. (.24 per cent. $H_2O_2 = 1:400$), while the same amount failed to destroy the vitality of the micrococcus of pus,—pure culture obtained from an acute abscess,—showing a difference in the resisting power of these two organisms.

As the solution used in these experiments contained 5 per cent. of sulphuric acid, which in a previous series of experiments[1] has been shown by the writer to be fatal to the micrococcus of pus in the proportion of 1 : 200, it is evident that a failure to destroy the vitality of the same micrococcus in 1 : 400 does not give this solution any very notable advantage over a simple aqueous solution of sulphuric acid. The germicide power of the solution used, as tested by its action upon spores, is, however, considerably above that of sulphuric acid alone. Dr. Duggan has ascertained that to destroy all of the organisms in broken-down beef tea requires 8 per cent. of H_2SO_4, whereas 30 per cent. of our solution of H_2O_2, containing 5 per cent. of sulphuric acid ($= 1.5$ per cent. of H_2SO_4), is effective.

These experiments indicate that unless chemists can furnish us solutions which are more concentrated and which will keep better, we are not likely to derive any great practical benefit from the use of hydrogen peroxide as a disinfectant.

As an antiseptic, our solution was found by Dr. Duggan to be effective

[1] *American Journal of the Medical Sciences*, April, 1883.

in the proportion of 1 : 5000 (of H_2O_2, not of the dilute solution), and to fail in the proportion of 1 : 10,000. This does not correspond with the results reported by Miquel, who places hydrogen peroxide—*eau oxygenee*—above mercuric chloride as an antiseptic. In his table of the minimum amount of different antiseptic agents which will prevent the putrefaction of one litre of neutralized beef tea, the quantity of H_2O_2 required is stated to be .05 gramme (1 : 20,000), while the amount of mercuric chloride required to accomplish the same results is given as .07 gramme (= 1 : 14,285).

CHLORINE, BROMINE, AND IODINE.

BY GEORGE H. ROHÉ.

Chlorine.—The most thorough and exact research into the disinfectant powers of chlorine on record is that made by Fischer and Proskauer, and published in the second volume of *Mittheilungen aus dem Kaiserlichen Gesundheitsamte.* The material tested consisted of the spores of bacillus anthracis, spores of the various forms of bacilli found in ordinary garden soil, micrococcus tetragenus, micrococcus prodigiosus, bacillus of septicæmia of mice, bacillus of septicæmia of rabbits, aspergillus nigrescens and aspergillus ruber, micrococcus of erysipelas, sputum of tuberculosis, bacillus anthracis, bacterium of fowl cholera, and various other non-pathogenic micro-organisms.

The observations were made both in dry air and in air artificially moistened, and the objects to be disinfected were sometimes exposed in a dry, sometimes in a moist, condition. The concentration of the gas varied from 1 part in 25,000 to 1 part in 2½. The time of exposure in the different experiments varied from one to twenty-four hours.

Anthrax spores, when thoroughly desiccated and exposed to the action of a dry chlorine atmosphere containing 44.7 parts of chlorine in 100, resisted the disinfectant action of the agent completely for one hour. After three hours' exposure, germination was still free, but somewhat retarded. After twenty-four hours' exposure, disinfection was complete, the vitality of the organism being entirely destroyed.

When the air in the experimental chamber and the spores were moistened, one hour's exposure to an atmosphere containing 4 per cent. of chlorine was sufficient to produce complete disinfection. If the exposure was continued for three hours, 1 per cent. of chlorine was an efficient disinfectant; and if the spores were exposed for twenty-four hours, the effective proportion of chlorine could be still further reduced if the air and objects to be disinfected were first rendered moist.

Bacillus anthracis itself was killed in moist air, if chlorine was present, in the proportion of 1 part in 2,500 after twenty-four hours' exposure. Even with such a minute proportion of chlorine as 1 part in 25,000, the development of the organism was scanty and retarded.

Spores of the various forms of bacilli found in ordinary garden soil proved a little more resistant to the action of the chlorine. When the air in the experimental chamber was very moist, however, the presence of 1 per cent. of chlorine, and upward, rendered the spores incapable of development after three hours' exposure. When the chlorine strength was 4 per cent., one hour's exposure was sufficient to destroy the germinative power of these spores.

Micrococcus tetragenus was killed in moist air by the presence of so small a proportion of chlorine as 1 in 25,000, if the exposure was prolonged to twenty-four hours. Exposure for less than three hours was not sufficient to destroy the life of the organisms in all cases.

Micrococcus prodigiosus, and several other varieties of pigment-forming micrococci, showed themselves generally more resistant to the disinfectant than micrococcus tetragenus. In other respects they behaved similarly, exposure for upward of three hours being sufficient to destroy them in the presence of over 4 per cent. of chlorine.

Aspergillus nigrescens and aspergillus ruber were rendered incapable of further growth by exposure for one hour to moist air containing 1 part of chlorine in 25,000.

Micrococcus of erysipelas was killed by three hours' exposure to moist air containing 1 part of chlorine in 2,500, or twenty-four hours' exposure to air containing 1 in 25,000.

Bacillus of septicæmia of mice was killed by exposure to an atmosphere containing from 3 to 40 parts of chlorine in 1,000. The presence of 5 parts in 1,000 was effective after one hour's exposure in a moist atmosphere.

Bacillus of septicæmia of rabbits was killed by an exposure of twenty-four hours to 5 parts in 1,000, and after one hour's exposure to 40 parts in 1,000, but retained its infective properties after one hour's exposure to 5 parts in 1,000.

Tuberculous sputum was disinfected after one hour's exposure to an atmosphere containing 5 parts of chlorine in 1,000.

Bacterium of fowl cholera was destroyed after exposure for twenty-four hours to a moist atmosphere containing 1 part of chlorine in 25,000.

Dr. G. M. Sternberg (*Report National Board of Health*, 1880, p. 320) tested the effect of chlorine upon dried vaccine lymph and the micro-organisms of putrid urine. Six hours' exposure of vaccine lymph, dried upon ivory points, to an atmosphere containing 1 part of chlorine in 200 was sufficient to destroy the infective property of the lymph, as tested by subsequent inoculation. In one experiment five points were exposed to an atmosphere containing 1 per cent. of chlorine. Of these, four were disinfected, while the fifth furnished a satisfactory vaccine vesicle. The failure in this case is explained by Dr. Sternberg by the assumption of an unusually thick coating of dried lymph. In these experiments control-inoculations with non-disinfected virus from the same packages were made in all cases.

The bacteria of putrid urine were destroyed after six hours' exposure to an atmosphere containing 1 part of chlorine in 400.

Braidwood and Vacher ("Report of Life-History of Contagium," *British Medical Journal*, 1876, vol. ii) mixed liquid vaccine virus with equal parts of liquor chlori (B. P.), and completely destroyed the infectivity of the vaccine. The time of exposure is not stated.

Dr. E. B. Baxter (*Report of Medical Officer Privy Council*, 1875), tested the effect of chlorine on liquid and dry vaccine, and on the "virus of infective inflammation." The infectivity of the latter was destroyed by the presence of 8 to 15 parts of chlorine in 10,000. The time of exposure to the action of the disinfectant is not stated. The experiments of Dr. Baxter on vaccine lymph are not detailed with sufficient exactness to allow trustworthy conclusions to be drawn. He states, however, that "unless the chlorine was present in sufficient quantity to render the lymph acid, it had no effect."

Koch (*Mittheilungen a. d. Kais. Gesundheitsamte*, Bd. I, p. 263) found that anthrax spores lost their power of development when immersed for twenty-four hours in chlorine water.

Fischer and Proskauer, in addition to testing the influence of chlorine on micro-life, also exposed a number of fabrics, colored leather, and wearing apparel to the action of this agent. All the colored articles were either bleached or much altered in color. They conclude their elaborate memoir with the following observation:

Disinfection with chlorine is attended by great inconvenience on account of the rapid evolution of the gas from the chlorinated lime and hydrochloric acid when mixed, and the very irritant action of the gas upon the mucous membrane of the larynx and of the eyes. Clothing is also liable to be discolored by the action of this disinfectant.

Bromine.—Fischer and Proskauer (*ibid.*) also studied the effect of the vapor of bromine upon spores of bacillus anthracis, spores of garden soil bacilli, tuberculous sputum, bacillus anthracis, micrococcus prodigiosus, micrococcus tetragenus, micrococcus of erysipelas, aspergillus nigrescens, aspergillus ruber, and several other non-pathogenic organisms.

After an exposure of three hours in a dry atmosphere containing 3 parts of bromine vapor in 100, the anthrax bacillus, tuberculous sputum, and both aspergillus species were entirely disinfected. The spore-bearing organisms and the non-pathogenic micrococci retained their power of development, although generally in a diminished degree. After moistening the air in the experimental chamber to the greatest attainable degree, three hours' exposure to an atmosphere containing 1 part of bromine in 500 acted as a thorough disinfectant; if the exposure was prolonged to twenty-four hours, 1 part in 3,500 was efficient. When the proportion of bromine was reduced to 1 part in 16,000, exposure for twenty-four hours failed to disinfect spore-bearing organisms.

Upon the whole, bromine did not prove as prompt a disinfectant as chlorine, besides being very difficult and dangerous to handle.

Koch[1] found a 2 per cent. aqueous solution of bromine effective against anthrax spores after twenty-four hours' exposure.

[1] Loco cit.

Iodine.—The disinfecting power of iodine has been determined by Dr. G. M. Sternberg (*American Journal of the Medical Sciences*, April, 1883). He experimented upon the micrococci of pus and of septicæmia, bacterium termo, and the organisms found in broken-down beef tea. An exposure of two hours to the disinfectant in solution, in the proportion of 1 in 500, was effective in destroying the vitality of all of these organisms.

Salmon (*Report of United States Department of Agriculture*, 1883) experimented on the micrococcus of fowl cholera, and found iodine an efficient disinfectant in the proportion of 1 part in 1,000.

A solution of iodine in water (strength not given) was found by Koch[1] to destroy the spores of *B. anthracis* after twenty-four hours' exposure.

Summing up briefly our knowledge upon this subject, the following conclusions seem to be justified:

1. Chlorine is an efficient disinfectant when present in the proportion of 1 part in 100, provided the air and the objects to be disinfected are in a moist state, and the exposure continues for upwards of one hour.

2. Chlorine, when used in sufficient concentration to act as a trustworthy disinfectant, injures colored fabrics and wearing apparel.

3. Bromine is an efficient disinfectant in the proportion of 1 part in 500, provided the air be in a moist state, and the exposure continues for upwards of three hours.

4. Iodine, in solution, is an efficient disinfectant in the proportion of 1 part in 500, the exposure continuing for two hours.

5. The use of chlorine, and in a greater degree of bromine, requires considerable experience in management. When carelessly handled they may cause inconvenient or even dangerous symptoms in persons using them. For these reasons they are not suitable as disinfectants for popular use.

CARBOLIC ACID.

BY CHARLES SMART.

Carbolic acid may be said to have been recognized as an antiseptic from the time of its discovery by Runge, in 1834, in the distillate from coal-tar. This is sufficiently attested by the analogies which led to the use of the name *coal-tar creosote*, and the well known preservative action of the product from wood. In Watt's *Chemical Dictionary* we are informed, concerning the properties of carbolic acid, that "fish and leeches die when immersed in the aqueous solution, and their bodies subsequently dry up on exposure to the air without putrefying." The deodorant action of the acid was recognized as due not to a destruction of the offensive products of putrefaction, as in the case of some chemicals, but to an influence on the process which gave rise to them. When this process was shown to be dependent on the development, growth, and multiplication of certain bacterial forms, a destruction of their germs,

[1] Loc. cit.

or at least an interference with the conditions congenial to their growth, was of necessity assumed.

On this, Prof. Lister, in 1867, based the use of the acid in antiseptic surgery. The success attending his method of treatment spread the fame of carbolic acid, and its known and well proved antiseptic properties led to its investure with disinfectant properties which were by no means proved. It was used largely as a disinfectant in Europe, and for several years was held in a similar high repute in this country.

The first experiments to test its value failed to distinguish between the antiseptic and the disinfectant properties. As late as 1870, Grace Calvert's experiments[1] had a reference only to the delay in the exhalation of putrefactive odors from organic substances. Albumen and flour paste, which became offensive in five and seven days respectively when exposed to the air, were preserved for eleven and twenty-five days when mixed with five per cent. of the acid. Even the experiments of Shroeter,[2] in 1878, seem mainly directed to define an antiseptic value. A liquid, characterized only as teeming with bacteria, had its contained organisms rendered motionless and precipitated by the addition of .05 per cent. of the acid—a dilution of 1 : 2000. Raw flesh in a dilution of 1 : 10,000=.01 per cent., began to putrefy at the end of six days; in 1 : 2000=.05 per cent., the liquid, notwithstanding the presence of the flesh, remained clear and without odor for four weeks; in 1 : 1000=.1 per cent., the preservation was prolonged from six to eight weeks; while in 1 : 500= .2 per cent. the liquid remained clear and free from all organisms for many months. Hence, he considered that a solution containing .1 per cent. of the acid is one in which no low organisms can exist, and that a dilution of .01 per cent. will retard their development for some time.

The acid was recognized as being specially destructive to the moulds, a much smaller quantity sufficing to destroy them than was requisite to insure protection from the bacteria of putrefaction. Thus, Baxter[3] quotes Manassein as authority for the statement that one sixteenth of one per cent. deprived the spores of penicillium of their germinating power; and Schroeter found that the vapor of the acid arrested the development of penicillium and mucor, and destroyed their spores. One thorough fumigation of a mould-infected chamber acted so radically that for six weeks afterwards no trace of the fungi was discovered.

It became evident, however, to the experimenters having this matter in view, that the acid might interfere with the development of the bacteria of putrefaction without destroying their power of multiplication when transferred to a more congenial environment. Hence, culture experiments were instituted on the bacteria that had been subjected to the influence of the acid. Moreover, it was recognized that experiments on the bacteria of putrefaction were by no means satisfactory as argu-

[1] *Chemical News*, London, 1870, vol. xxiii, p. 281.

[2] "Beitrage zur Biologie der Pflanzen," Breslau, 1878, 3 Heft, S. 30 *et seq.*

[3] "Report of the Medical Officers of the Privy Council and Local Gov't Board." London, 1875. P. 216, *et seq.*

ments on the vitality of the disease germs which were concerned in the process of disinfection. Hence were instituted experiments on certain infective matters.

Braidwood and Vacher investigated the action of the acid on vaccine lymph in 1870, and verified their results in 1876.[1] On four children vaccinated with lymph containing 2.5 per cent. of acid, six vesicles were obtained at ten points of insertion. In these instances the lymph was removed from the arm, mixed in a watch-glass with the acid, and applied at once. A second group of children, five in number, were vaccinated in a similar way; but the mixtures used had been preserved in Husband's capillary tubes for seventeen days, three weeks, four weeks, and six weeks respectively. These inoculations all failed, and the children afterwards underwent a successful normal vaccination. Similar results were obtained by trying the carbolated lymph on a heifer.

Meanwhile, Dougall, in 1873, operated on vaccine lymph, making use of subsequent vaccination as the test of the action of the carbolic acid on the virus. He exposed the lymph in a bell jar of one cubic foot capacity for thirty-six hours, and after mixing it with glycerine and water, sealed it up in capillary tubes until used for vaccination. The lymph thus treated produced satisfactory vesicles. Led by this result, he then treated fresh vaccine with one per cent. of pure carbolic acid, and found its infective property undiminished. But about the same time Hoppe Seyler[2] determined that two per cent. of the acid destroyed the activity of vaccine virus; and two years later, Baxter, in his careful work for the British health authorities, was also successful in destroying the virus, as proved by subsequent inoculation with the disinfected matter. He exposed dry vaccine to carbolic acid vapor in a bottle one third filled with the acid, and found that when the period of exposure was less than thirty minutes the infection was but slightly if at all impaired. When the exposure extended to thirty minutes, disinfection was effected in one specimen, while another produced two vesicles for three insertions. In two instances, in which the exposure was prolonged for sixty minutes, the virus proved inefficient when subsequently used. He also found that while the presence of one per cent. of carbolic acid in liquid vaccine exerted no influence on its activity, two per cent. destroyed its infective power with certainty.

Dougall, returning to this subject in 1879,[3] concluded from some of his experiments that if the vaccine were used immediately after its exposure to the carbolic acid, or if hermetically sealed in the meantime, the virus would fail, but that if exposed to the air after being carbolized it would recover its activity. Thus sixty parts of vaccine and forty of acid, when used immediately after mixture, gave no results, but when used after a free exposure to the air during fourteen days, it was found to have recovered its active properties. He therefore concluded that the infected

[1] "British Med. Association. Scientific Reports." London, 1876.

[2] *Arch. Gen.*, May, 1863, p. 633.

[3] *British Med. Jour.*, 1879, vol. ii, p. 726.

particles of the lymph became covered with coagulated albumen of the vaccine liquid, and that in vaccination the free acid coagulated the contents of the dermal capillaries and rendered absorption impossible. But these experiments of Dr. Dougall did not succeed in the hands of J. W. Miller, of Dundee.[1]

He prepared four specimens, each containing two parts of carbolic acid and three of vaccine. The mixtures were exposed to the air for fourteen days before use ; and in each of the four experiments the lymph was barren. Two experiments were made with vaccine which had been exposed to the air for fourteen days after its admixture with five per cent. of the acid ; in one of these the lymph was barren, in the other an imperfect vesicle was obtained. One experiment, however, appeared to verify Dr. Dougall's results : equal parts of vaccine and glycerine of carbolic acid, after exposure to the air during fourteen days, yielded a good vesicle. But Miller was inclined to view this result with suspicion, and attributed it to pure lymph rubbed off by inadvertence from some of the other points of insertion on the child's arm.

But other liquids containing germs or infective matter were used by the investigators. Rosenbach,[2] in 1873, injected dogs and rabbits with unhealthy pus, to which five per cent. of the acid had been added, the general tenor of his results showing that disinfection had been accomplished. Baxter, two years later, experimented with the virus derived from the peritoneal cavity of guinea-pigs that had succumbed to infective peritonitis. The length of time during which the virus was exposed to the action of the acid varied from thirty minutes to three hours, thorough admixture having been effected in the meantime. In one set of experiments, two per cent. and one per cent. of the acid destroyed the infection, as the animals inoculated with the mixture did not suffer. In a second series of experiments, one per cent. was efficient for protection, but with a virus containing only .5 per cent. the animal died in forty hours from acute cellulitis. In a third series, one per cent. was efficient, but death occurred with .5 per cent. in eighteen hours. In the fourth series, one per cent. proved again protective against the infective material. Similar inoculation experiments with the virus of glanders showed that two per cent. of carbolic acid destroyed its infection, while .5 per cent. failed to act as a disinfectant.

By culture experiments, Sternberg, in 1883,[3] showed that the micrococcus of pus has its vitality destroyed so that it fails to develop when introduced into a sterilized bouillon after an admixture of two hours with .8 per cent. of the acid, while with .5 per cent. its subsequent cultivation was successful ; and that the micrococcus of septicæmia is destroyed by .5, but not by .25 per cent. This defines the germicide limits of the acid in respect to these organisms. On the other hand, when carbolic acid was added to the sterilized culture-liquid, a much smaller per-

[1] *Med. Record*, Sept., 1873, p. 427.

[2] *Practitioner*, Sept., 1884, p. 146.

[3] *Amer. Jour. Med. Sciences*, April, 1883.

centage than was needful for a germicidal action sufficed to prevent the development of the micrococci of pus and of septicæmia when implanted for cultivation. Thus, .2 per cent. prevented the development of the organisms, while .1 per cent. failed to protect the culture-liquid from its attack. Similar results were obtained with the micrococcus of septicæmia. This defines the antiseptic limits of the acid in respect to these organisms.

Baxter was of opinion that the length of time during which the acid was permitted to act upon the infective material was of no importance, provided that thorough mixture was insured. This implies a belief in the instantaneous action of the acid on the active principle of the virus. Some experiments by Koch[1] in 1881, Salmon[2] in 1883, and Schill and Fischer[3] in 1884, indicate that time of exposure, as well as strength of solution, enters as an element into the question of disinfection. Thus, the last mentioned investigators, operating on fresh tubercular sputa, found that disinfection was accomplished by treatment with three, two, or even one per cent. of acid for twenty hours; but that five per cent. failed to disinfect when the period of digestion was limited to two hours. Post-mortem examinations discovered sound organs in the animals inoculated with the former mixtures, and tubercular disease in those of the specimens treated with the latter and stronger mixture. Salmon, operating on the micrococcus of fowl cholera, obtained the destruction of the virus by one per cent. of the acid, the test being inoculation. In some experiments, in which the test was cultivation, one per cent. succeeded, and .5 per cent. failed to destroy the power of germination when the digestion with the acid was continued for one and a half hours; but. 5 per cent. was successful when the digestion was prolonged for twenty-four hours.

The bacilli and spores of anthrax have been subjected to a number of experiments, of which those of Davaine[4] are the earliest. The blood of an infected animal, diluted with one hundred parts of water, was used. This was found to be speedily fatal to guinea-pigs when injected under the skin, but its virulence was destroyed on treatment for an hour with one per cent. of carbolic acid. Koch found that the *spores* of anthrax had their vitality destroyed by immersion for twenty-four hours in a five per cent. aqueous solution of the acid. A two per cent. solution was not efficacious; but after five days' digestion in this solution the development of the spores was somewhat retarded. Further experiments showed entire failure of disinfection with a one and two per cent. solution; success after seven days with three per cent.; after three days with four per cent. and after two days with a five per cent. solution. Culture in gelatine was the test employed in these instances. On the other hand, the *bacilli* were destroyed by exposure of from two to twenty-five minutes in aqueous solutions containing from five to one per cent. of the acid, the

[1] "Mitt. a. d. Kais. Gesundheitsamte," 1881, vol. 1.

[2] "Report Dept. Agriculture, U. S." 1883.

[3] "Mitt. a. d. Kais. Gesundheitsamte," 1883, vol. ii.

[4] *Comptes Rendus*, Oct. 13, 1873.

test being culture in solidified blood-serum. The culture in gelatine of the anthrax *spores* was not prevented by their antecedent immersion for one hundred and ten days in oil containing five per cent. of the acid, nor by seventy days in alcohol of the same carbolic strength. An oleaginous five per cent. solution diminished the development of the *bacilli* in three or four days, and accomplished disinfection on the sixth day, as shown by the failure of subsequent efforts at cultivation. Even a one per cent. solution in oil destroyed their power of development on the sixth day, but it is to be observed that a similar result followed the use of pure olive oil. Arloing, Cornevin, and Thomas[1] found that the virulence of anthrax spores persisted after an immersion of forty-eight hours in alcohol containing two per cent. of the acid, while it was destroyed by the action of the same percentage in water. Blyth[2] also experimented with these spores. He showed the inefficiency of the carbolic acid powders—Calvert's, Jeyes's, and McDougall's. The spores invariably developed notwithstanding contact with the powder for twenty-four hours. A one per cent. carbolic solution had no effect on their development; five per cent. retarded their growth; twenty-five per cent. in alcohol rendered them incapable of germinating in broth.

While these investigators were testing the power of carbolic acid on certain disease-producing substances, many series of experiments were performed on the bacteria of putrefaction, with a view of determining the germicidal as well as the antiseptic powers of the acid on the organisms, the latter being expressed by the quantity of acid required to be added to a nutritive liquid in order to restrain their growth, and the former to prevent them from multiplying when subsequently transferred to a suitable culture-liquid.

Baxter's experiments showed that .5 and .1 per cent. were required for the germicidal action, the larger percentage being requisite when the liquid was albuminous. Hamlet,[3] operating on Pasteur's liquid containing *B. punctum*, *B. termo*, and *M. crepusculum*, found a slight diminution in the number of moving bacteria after standing five days mixed with one per cent. of carbolic acid, while with five per cent. few of the bacteria showed signs of movement. Nevertheless, in this last experiment their vitality persisted, for when a little of the solution was transferred to a large quantity of Pasteur's liquid, the whole was in two days teeming with bacteria. Notter's[4] results were to the effect that 3.3, 5, and 6 per cent. of carbolic acid did not destroy the movements of the bacteria in a putrid infusion of beef, even after the lapse of seven days. Jalan de la Croix[5] found that when two drops of a liquid teeming with bacteria are added to a sterilized meat-juice, the acid must be present in the proportion 1 : 669 to prevent development; but to produce a germi-

[1] *Comptes Rendus Soc. de Biolog.* Septieme serie, t. iv.

[2] *Medical Times and Gazette*, Oct. 11, 1884, p. 498.

[3] *Jour. Chem. Soc.*, London, 1881, xxxix, p. 326.

[4] *Dublin Jour. Med. Sciences*, 1879, vol. 68, p. 196.

[5] "Arch. fuer Experimentelle Pathologie." Leipzig, 1881, p. 175, *et. seq.*

cidal effect in this weak bacterial liquid, acid in the proportion 1:22 had to be added. The bacteria in broken-down meat infusion were killed by immersion for twenty-four hours in a solution of 1:22, although not in 1:42; but to prevent the development of germs when this liquid was introduced into a sterilized infusion, it was necessary to give them a preparatory soaking for twenty-four hours in an acid of the strength 1:2.66, for a solution of 1:4 did not deprive them of their fecundity. To prevent the decomposition of boiled meat-juice by germs falling into it from the air, 1:402 was required; but for an unboiled infusion 1:502 sufficed; and to prevent the development of the germs in the former when transferred to a sterilized liquid, 1:22 was required, while those in the latter were not deprived of their germinating power by 1:10. Vallin[1] justly remarks of De la Croix's experiments, that they must be accepted with some reserve, since it is contrary to the general experience that a boiled liquid should require more of an antiseptic to preserve it than one which had not been boiled. Sternberg found that .2 per cent. was antiseptic in view of *B. termo*, but one per cent. was required for action as a germicide. He further found that the bacteria in broken-down beef tea retained their vitality after an exposure of two hours to a four per cent. solution.

Turning from these experiments in which the carbolic acid was used in the form of liquid to those in which its vapor was employed, we find the following, in addition to those already mentioned in connection with antiseptics, the destruction of moulds, and of the vaccine efficiency.

Perrin and Marty[2] failed to prevent the decomposition of barley-water, milk, blood, urine, etc., by the atomization of a five per cent. carbolic liquid. Schotte and Gartner[3] volatilized carbolic acid by heat in a closed chamber in which were exposed to the action of the vapor liquids containing bacteria and woollen cloths that had been dipped in these liquids, determining at the close of the exposure whether the fecundity of the bacteria had survived by transferring them to a sterilized culture-liquid. For efficient disinfection, rapid evolution of the carbolic vapors was required. The bacteria in the exposed liquids were destroyed by the diffusion of 7.5 grammes of carbolic acid per cubic metre, but those in the impregnated cloths required a stronger diffusion, 12.5 grammes, when the fabrics were damp, and 15 grammes when they were dry.

From a survey of these experiments on carbolic acid, performed since the introduction of methods of precision in testing germicidal or disinfectant properties, the value of the acid in these respects may be determined.

One per cent. in an aqueous solution has destroyed with certainty the virulence of septic and purulent matters, of the tubercle bacillus, and of the micrococci of fowl cholera; some of the organisms related to putrefaction have also been destroyed by solutions of this strength. But to

[1] "Traité des Désinfectants et de la Désinfection." Paris, 1882, p. 163.

[2] "Bulletin de la Soc. de Chir.," 1879, t. v., p. 153.

[3] "Deutscher Verein fur Oeffentliche Gesundhpflege," 1880, t. xii, p. 337, *et seq.*

produce these results, in some instances, the contact with the disinfectant had to be continued for many hours. Two per cent. of the acid in an aqueous solution was required to destroy the infection of vaccine and glanders; but some of the experiments on the former seem to indicate that no destruction of the virus was effected, but merely a suspension of its powers, which were recovered on the dissipation of the acid by subsequent prolonged exposure to the air. The spores of anthrax did not lose their ability to germinate unless treated with a five per cent. solution for twenty-four hours, or with a weaker solution for a longer time. Lastly, as showing how little reliance can be placed on carbolic acid as a disinfectant, except in special instances, as in those above mentioned where its effects have been determined, the organisms in broken-down beef tea were not deprived of their reproductive powers by treatment with four per cent. acid, Sternberg, nor with six per cent., Notter, nor with ten per cent., De la Croix;—the last observer, indeed, asserts that about thirty per cent. (1 : 2.66) was needful to effect this object.

The large percentage of the acid required for disinfectant or germicidal action when applied directly in the liquid form, prepares us for its failure when used in the form of vapor. Douglas and Baxter, from the results of their experiments on vaccine, concluded that aërial disinfection by carbolic acid vapor was practically impossible. The atomizer, however, offered better facilities for the diffusion of the vapor; and Strott[1] in 1876, and Wernich[2] in 1883, recommended the use of the spray as protective against albuminoid contagious principles. But the experiments of Perrin and Marty, and of Schotte and Gartner, demonstrated its inutility as against bacterial life.

The valuable antiseptic properties of the acid do not come within the scope of this article, although they have been in a measure indicated incidentally.

DISINFECTION WITH MINERAL ACIDS.

BY VICTOR C. VAUGHAN.

Disinfection with mineral acids in one form or another has long been practised. Sulphurous acid was used by the ancient Greeks in the purification of their temples after sacrificial offerings had been made. In 1773 Morveau recommended the vapor of hydrochloric acid, produced by the action of sulphuric acid on sodium chloride. In 1780 Smyth began the use of nitrous acid vapor as a disinfectant. During the present century, many experiments have been made for the purpose of determining the value of the mineral acids as disinfectants, both in liquid and in vapor form. It is the purpose of this paper to review briefly these reports, and to ascertain what conclusions may be drawn therefrom. Since sulphu-

[1] "Ventilation und Desinfection der Wohnraume," Holtzminden, 1876, p. 19.

[2] "Real-Encyclopadie der Gesammten," Heilkunde, 1883, B. 15, S. 170, *et seq.*

rous acid will be discussed in another paper, no further mention will be made of it here.[1]

Hydrochloric Acid. Dougall[2] found that vaccine virus, exposed under a bell-jar of a cubic foot capacity, for twenty-four hours, to the vapor of the acid, became inert. After exposure, the lymph was mixed with glycerine and water, and the reaction of the mixture (acid) was noted. The mixture was then hermetically sealed in tubes, and so kept until used. Dr. Dougall believed that the effectiveness of the vapor was due to its rendering the virus acid. In proof of this he gives the following tabular statement of the reaction of the lymph and glycerine mixture used in his successful and unsuccessful vaccinations after exposure to different agents:

Successful vaccination. Virus not destroyed.	Reaction of the lymph and glycerine mixture.	Vaccination not successful. Virus destroyed.	Reaction of the lymph and glycerine mixture.
Carbolic acid vapor.	Nutral.	Chloride of lime.	Acid.
Carbolic acid.	"	Sulphurous acid.	"
Chloroform.	Alkaline.	Nitrous acid.	"
Camphor.	"	Glacial acetic acid.	"
Sulphuric ether.	"	Hydrochloric acid.	"
Iodine.	Neutral.		

Commenting upon the above table, Dr. Dougall states,—"These results *per se* are singularly and suggestively explicit. They show that the mixture of lymph and glycerine of the successful vaccinations was either neutral or alkaline; while that of the unsuccessful was, without exception, acid. Hence, volatile acids, or a volatile body causing acidity by chemical affinity, as the chlorine from the chloride of lime, which produces hypochloric acid and free oxygen, are the best destructives of the active properties of vaccine lymph, and therefore *a priori* of variolous matter and other zymotica.[3] The same theory is insisted upon by Dr. Dougall in a later paper.[4] Results with hydrochloric acid vapor, similar to those obtained by Dougall, were reached by Braidwood and Vacher in eight experiments.[5]

Koch[6] ascertained by cultivation that anthrax spores were destroyed

[1]See papers by Drs. Sternberg and Raymond in this series of reports.

[2]"Glasgow Medical Journal," vol. 5, p. 166.

[3]Loc. cit., p. 168.

[4]"British Med. Journ.," voi. ii, p. 726, 1879.

[5]Life History of Contagium.

[6]Mittheilungen a. d. Kais. Gesundheitsamte, B. I. S. 263.

after ten days' exposure to a 2 per cent. solution of the acid; but that exposure from one to five days failed to destroy the spores.

Dr. Sternberg, in some experiments made for this report, found hydrochloric acid to fail as a disinfectant when used in 10 per cent. solution, and to be successful when the strength was increased to 15 per cent. Each c. c. of the acid used by Dr. Sternberg contained .395 gramme of HCl.

Sulphuric Acid. Koch[1] noticed diminished development of anthrax spores after exposure to a 1 per cent. solution of sulphuric acid for twenty days. The test was by cultivation. Salmon,[2] experimenting upon the micrococcus of fowl cholera, found one half per cent. solution of sulphuric acid successful as a disinfectant, tested by inoculation; but one fourth and one eighth per cent. solutions unsuccessful, tested by cultivation. Sternberg[3] states that "sulphuric acid destroys *B. termo* and the two species of micrococcus experimented upon in the proportion of 1 : 200; but a 4 per cent. solution failed to destroy the bacteria in broken-down beef tea (old stock), doubtless because of the presence of reproductive spores. The multiplication of the bacteria mentioned was prevented by the presence of this acid in a culture solution of 1 : 800. Dr. Sternberg has given the per cent. of sulphuric acid necessary to insure disinfection at 8. Each c. c. of the acid used contained 1.480 gramme H_2SO_4.

Nitrous Acid. Dougall[4] found that vaccine lymph, exposed to nitrous acid under a bell-jar of one cubic foot capacity for twenty-four hours, was rendered inert. The lymph was treated as given under hypochloric acid, and the action was supposed to be due to rendering the lymph acid.

Notter[5] has experimented upon nitrous acid as an aërial disinfectant. However, his conclusions are not wholly trustworthy, as he considered the bacteria destroyed, when their motion was only arrested. He says,—"I believe the full effect of the agent to be produced when there is arrest of motion, with complete precipitation and disorganization of the bacteria, and I have endeavored in each case to look for this result. One hundred c. c. of putrid beef infusion in saucers were placed in a chamber, of a cubic capacity of fifty-three feet, with two ounces of copper wire, and fifty c. c. of concentrated nitric acid, yielding .35 per cent. of nitrous acid. Soon the bacteria became less active, and in forty-eight hours the activity was still further diminished, and a heavy precipitation of the organisms was noticed. The infusion was free from odor. On the third day there was no tendency to the further development of the bacteria, and the liquid was quite inodorous. At the end of a week there was no further decomposition, and the infusion was found to be strongly acid.

Sternberg[6] found that exposure of vaccine virus for six hours to an atmosphere containing 1 per cent. of nitrous acid vapor destroyed the

[1] Loc. cit., p. 264.

[2] Report Dept. Agriculture, 1883.

[3] Bacteria, p. 223.

[4] Loc. cit.

[5] "Dublin Journal Med. Sciences," vol. 71, p. 508.

[6] National Board of Health Bulletin, p. 287.

germs; also, that the bacteria of putrid urine was destroyed when exposed on filter paper for six hours to an atmosphere containing one half per cent. of nitrous acid gas.

Nitric Acid. Dr. Sternberg has ascertained that nitric acid fails as a disinfectant in solutions of 5 per cent., but is effectual in solutions of 8 per cent. Each c. c. of the acid used contained .819 gramme of HNO_3.

Chromic Acid. Koch[1] ascertained that anthrax spores were destroyed by exposure to 1 per cent. solutions of chromic acid after from one to two days.

Osmic Acid. Koch[2] found, by cultivation, that anthrax spores were destroyed by exposure for twenty-four hours to 1 per cent. of osmic acid.

Practical Considerations of the Use of the Mineral Acids as Disinfectants. The action of 10 and 5 per cent. solutions of sulphuric, nitric, and hydrochloric acids upon lead pipes was tried, with the results given in the accompanying table. Weighed pieces of lead pipe were placed in the dilute acids, and the loss was determined by subsequent weighings. This represents a more powerful action than would result simply from the rapid passage of the disinfectant through the pipes; but the table gives results which would be obtained by the solution standing in a trap. At the time of each weighing, the dilute acid was replaced by a fresh portion.

The experiments were continued until the nitric acid had completely destroyed the pipe; but as the results are sufficiently shown by the following figures, it is unnecessary to give the table in full. After a number of days there was a slight increase in the weight of the pipes placed in the sulphuric acid solutions. All the acids used were of the commercial grade. We also have figures showing the action of the dilute acids upon iron pipes; but, as this action is rapidly destructive with all the acids, it is unnecessary to give the figures. In order of disintegrating effects upon iron pipes, sulphuric acid acts with most vigor; while there is not much difference in the effects produced by the same strength solutions of nitric and hydrochloric acids. The action upon zinc is in the same order as that given for iron; while the solvent action of nitric acid on tin was found to be greater than that of either sulphuric or hydrochloric acid.

[1] Loc. cit., S. 264.

[2] Loc. cit.

ACTION OF MINERAL ACIDS UPON LEAD PIPES.

Date of weighing and changing solution.	No. of days in the solution.	10 per cent. H_2SO_4		5 per cent. H_2SO_4		10 per cent. HNO_3		5 per cent. HNO_3		10 per cent. HCl		5 per cent. HCl	
		Weight of pipe.	Loss.	Weight of pipe.	Loss.	Weight of pipe.	Loss.	Weight of pipe.	Loss.	Weight of pipe.	Loss.	Weight of pipe.	Loss
		Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.	Grams.
Jan. 30, 1885.	0	53.120	..	52.990	..	53.000	....	53.000	....	53.000	....	53.000	....
Feb. 2, "	3	53.120	00	52.990	00	48.500	4.500	51.300	1.700	52.930	0.070	52.990	0.010
Feb. 3, "	1	53.120	00	52.990	00	44.220	4.280	49.350	1.880	52.900	0.030	52.970	0.020
Feb. 4, "	1	53.120	00	52.990	00	41.130	3.090	47.365	1.985	52.860	0.040	52.925	0.045
Feb. 6, "	2	52.120	00	52.990	00	34.520	6.610	44.400	2.965	52.845	0.015	52.920	0.005

THE METALLIC SULPHATES.

BY GEORGE M. STERNBERG.

The metallic sulphates have been largely recommended as "disinfectants," and directions for their use are to be found in the printed circulars of health authorities in this country and in Europe. In France the sulphate of copper is a favorite disinfectant, and, as I shall shortly show, is a reliable agent for the destruction of germs in the absence of spores. It is very much superior to ferric sulphate or zinc sulphate, which have been more extensively used in our own country.

The value of all these agents as antiseptics is beyond question; and when the object in view is to prevent the development of germs in privy-vaults, cess-pools, etc., a solution of "copperas," on account of its cheapness and efficiency, is especially to be recommended. But the directions often given for the use of dilute solutions of ferric sulphate or zinc sulphate, for the disinfection of the sputa of patients with diphtheria, the excreta of patients with cholera, typhoid fever, etc., are founded upon a mistaken estimate of the germicide power of these salts.

The metallic sulphates have all a certain value for the prevention of putrefactive fermentation, and for neutralization of the volatile products of putrefaction. They are therefore "disinfectants" in the popular acceptation of the term. Thus Vallin says,—

Metallic Sulphates in general.—These agents are disinfectants in the vulgar sense of the word. They diminish or cause to disappear bad odors, their action being limited to the neutralization of ammonia and the decomposition of sulphuretted hydrogen, or of the sulph-hydrate of ammonia.

In this group are the soluble salts of iron, of zinc, of copper, of manganese, and of lead. The oxides of these metals, which are quite cheap, have also been recommended for this purpose, but the salts have the advantage over the oxides of being able to saturate ammonia already formed, or that which results from the decomposition of the sulph-hydrate of ammonia. The oxide of iron, for example, can only fix sulphuretted hydrogen by forming the sulphuret of iron. The sulphate of iron produces in addition the sulphate of ammonia.

These salts, then, cannot neutralize all bad odors, and therefore they do not entirely merit the title of deodorants. Bad odors, indeed, owe their infection to a great quantity of diverse substances which have not been completely determined by chemistry, and of which scatol is one of the most recently discovered. It is, then, almost entirely the two badly smelling compounds which have been longest known, which are neutralized by these metallic salts.[1]

Virchow has pointed out one of the objections to the use of the sulphate of iron for disinfecting feces. The volatile fat acids, butyric, valerianic, etc., which have a disgusting odor and are highly toxic, are ordinarily combined with ammonia. When we throw sulphate of iron upon fecal matter, the sulphuric acid combines with the ammonia, and fetid products are given off, which are very volatile.

The immediate effect, therefore, of throwing sulphate of iron into latrines is frequently to augment the bad odor, which, however, soon diminishes, but ordinarily reappears after some time.[2]

In what follows we shall endeavor to fix the value of the metallic sulphates as *disinfectants*, in accordance with the definition of the term

[1] Traité des Désinfectants, p. 57.

[2] Op. cit., p. 63.

heretofore given by the Committee on Disinfectants, *i. e.*, the germicide value as fixed by biological tests.

Ferric Sulphate.—In the writer's experiments, published in the *American Journal of the Medical Sciences* (April, 1883), it was found that a saturated solution of ferric sulphate failed to destroy the growing power of any of the test organisms, the time of exposure being two hours. A recent experiment upon a micrococcus obtained from the pus of an acute abscess gave a similar result. The organism grew freely in culture solutions after exposure for two hours to a 10 per cent. solution.

According to Arloing, Cornevin, and Thomas, exposure to a 20 per cent. solution for forty-eight hours does not destroy the virus of symptomatic anthrax. The vitality of anthrax spores is not destroyed by exposure for six days in a 5 per cent. solution (Koch).[1]

Zinc Sulphate.—In the writer's experiments, reported in the *American Journal of the Medical Sciences* (l. c.), a solution of 20 per cent. of this salt failed to destroy the micrococcus of pus. In experiments recently made, the same micrococcus grew after exposure to a 10 per cent. solution for the same time (two hours), but development was somewhat retarded. Another micrococcus *(M. tetragenus)* was destroyed by a 10 per cent. solution in the same time. Broken-down beef tea, mixed in equal quantities with a 40 per cent. solution, was not sterilized at the end of two hours, as shown by culture experiments made in the usual way.

Koch found (l. c.) that a 5 per cent. solution had not destroyed the growing power of anthrax spores at the end of ten days, although their development was somewhat retarded.

Cupric Sulphate.—I have recently made experiments with this salt upon pure cultures of *B. anthracis* and of *B. subtilis*, and find that in a 20 per cent. solution (equal parts of a 40 per cent. solution and of the culture) it fails to destroy the vitality of the spores of these bacilli in two hours' time.

Arloing, Cornevin, and Thomas found that the dried virus of symptomatic anthrax is destroyed in forty-eight hours by a solution of this strength (20 per cent.). Koch found (l. c.) that a 5 per cent. solution did not destroy the vitality of anthrax spores at the end of ten days, although the rapidity of development was somewhat retarded.

The germicide power of this salt is, however, decidedly superior to that of the corresponding salt of iron or of zinc. I have demonstrated by recent experiments that it destroys micrococci in the proportion of .5 per cent. (= 1 : 200). The experiments were made upon a micrococcus derived from the pus of an acute abscess, and upon the micrococcus of swine plague. In one half the amount named (1 : 400) it failed to destroy the vitality of these micrococci.

This agent, then, is a valuable germicide, and may be safely recommended for the disinfection of material not containing spores. But none

[1]See table on p. 264 of the first volume of the "Mittheilungen aus dem Kaiserlichen Gesundheitsamte."

of the metallic sulphates can be relied upon for the destruction of spore-bearing pathogenic organisms, and the germicidal power of ferric and zinc sulphate is too feeble to make these salts available for disinfecting purposes, even in the absence of spores.

ZINC CHLORIDE.

BY GEORGE H. ROHÉ.

In his classical essay on disinfection,[1] Koch expresses astonishment that an agent, which proved almost entirely inefficient as a germicide in his experiments, should have obtained the widespread reputation as a disinfectant which chloride of zinc enjoys. He shows that anthrax spores, exposed to the action of a five per cent. solution (1 : 20) of this salt for thirty days, germinated as freely upon a suitable culture medium as similar material not so exposed. The development of micrococcus prodigiosus was only slightly retarded by exposure for upwards of sixteen hours to a one per cent. (1 : 100) solution. Anthrax spores developed freely in a one tenth per cent. (1 : 1000) solution of this salt.

Mr. A. W. Blyth[2] says a one per cent. (1 : 100) solution seemed to stimulate the growth of anthrax spores; five per cent. (1 : 20) failed to destroy their vitality; while twenty-five per cent. (1 : 4) seemed to arrest the life of the spores.

Dr. Sternberg[3] found two per cent. (1 : 50) destructive to the micrococcus of gonorrhœal pus, while one half per cent. (1 : 200) destroyed the power of development of the septic micrococcus. In Sternberg's later experiments[4] ten per cent. of Squibb's liquor zinci chloridi (said to contain fifty per cent. of anhydrous chloride of zinc) was found effective in destroying the organisms of broken-down beef tea. Numerous experiments have shown that these organisms are fully as resistant to most germicides as are the spores of *B. anthracis*. In order to clear up the apparent discrepancy between these observations of Koch and Sternberg, an additional series of experiments has recently been made by the latter, assisted by Dr. A. C. Abbott. These experiments showed that the spores of *B. anthracis* are not killed by an exposure for two hours to a ten per cent. (1 : 10) solution of this salt. A five per cent. (1 : 20) solution, acting for the same period, was, however, effective in destroying the spores of *B. subtilis*, and upon broken-down beef-peptone solution, which had been freely exposed to the air, and consequently contained a variety of micro-organisms. A two and a half per cent. solution (1 : 40) failed to sterilize putrid beef-peptone solution.

[1] Ueber Desinfection: Mittheilungen a. d. Kais. Gesundheitsamte. Bd. I. S. 261.

[2] *Medical Times and Gazette*, Oct. 11, 1883.

[3] *Am. Journ. Med. Sciences*, April, 1883, p. 331.

[4] *The Medical News*, Feb. 7, 1885.

The above experiments indicate that zinc chloride, in the proportion of five per cent. added to the material to be disinfected, can be relied upon for the destruction of micro-organisms in the absence of spores. To destroy the vitality of anthrax spores, however, a twenty per cent. solution is necessary.

MERCURIC CHLORIDE.

BY GEORGE M. STERNBERG.

The use of corrosive sublimate as a parasiticide and as an antiseptic agent for the preservation of animal tissues, etc., has long been known, but the researches which have established its value as a disinfectant are of comparatively recent date. These researches, made during the past four or five years, have demonstrated that bi-chloride of mercury occupies a leading place among known germicide agents. Miquel places mercuric iodide above the chloride as an antiseptic, and it may be that it has a correspondingly greater germicide value. But from a practical point of view the chloride must still be accorded the first place on account of its cheapness and solubility.

My own observations are in accord with those of Koch, of Jalan de la Croix and others, as to the power of this agent in dilute solutions (1 : 1,000 to 1 : 10,000) to destroy the spores of bacilli,—*B. anthracis* and *B. subtilis*,—and this constitutes the most difficult biological test known. Micrococci and bacilli in active growth, without spores, are killed by much weaker solutions (1 : 20,000 to 1 : 40,000).

Klein, of London, is, so far as I know, the only author who has reported results in conflict with these. In his recent work on *Micro-organisms and Disease*,[1] he says,—

> By sowing any micro-organism in a nourishing medium, to which has been added a certain substance (*e. g.*, carbolic acid to the amount of one per cent.), and exposing this medium to the conditions of temperature, moisture, etc., otherwise favorable to the growth of the organism, if we find after the lapse of a due period the growth is retarded or altogether inhibited, the conclusion is drawn that this substance (viz., the carbolic acid of 1 per cent.) is an antiseptic. There is nothing more fallacious than this mode of reasoning. A great many micro-organisms can be exposed to a 1 per cent. solution of carbolic acid for hours without in the least being affected, for on being transferred to a suitable nourishing medium they grow and thrive well. Similarly, by placing the spores of *B. anthracis* in a proteid medium containing perchloride of mercury of the strength of 1 in 300,000, it is found (as Koch has shown) that the spores are absolutely incapable of germinating. But if from this the conclusion is drawn that perchloride of mercury of the strength of 1 in 300,000 is a germicide, I should most strongly dissent,—for perchloride of mercury, even of the strength of 1 per cent., is not a germicide any more than vinegar; for on placing the spores of *B. anthracis* in a proteid medium, to which so much vinegar or any other acid has been added as makes it decidedly acid, it will be found that the spores do not germinate.

[1] *The Practitioner*, Lond., Oct., 1884, p. 251.

I have recently had occasion to object to the use of the terms antiseptic and germicide as synonymous, and the confusion resulting from such a misuse of the term *antiseptic* is exemplified in the above quotation. No one familiar with the present state of knowledge upon the subject would think of inferring that mercuric chloride is a germicide in the proportion of 1 : 300,000, because anthrax spores do not germinate in culture-fluids containing this amount. But an agent which prevents the development of putrefactive bacilli is an antiseptic, for putrefactive decomposition is prevented by such an agent as well as by one which kills germs. A germicide is necessarily an antiseptic, but an antiseptic is not necessarily a germicide. Thus alcohol, chloride of sodium, borax, sulphate of iron, and many other agents constantly used as antiseptics, do not in the most concentrated solutions destroy the vitality of the spores of bacilli, and consequently are not germicides.

The statement made by Klein, that "perchloride of mercury even of the strength of 1 per cent. is not a germicide any more than vinegar," is opposed by the experimental evidence reported *in detail* by Koch, and by my own extended experiments with this agent. I am convinced that there must have been some defect in Klein's method of working, and that the spores which killed his guinea-pigs had not been fairly exposed to the action of the disinfecting agent. He says,—

I have tried the action of a number of substances in common use as antiseptics (*e.g.*, Calvert's fluid, pure terebene, phenol 10 per cent., perchloride of mercury 1 per cent.), on the spores of *B. anthracis*, exposing these in comparatively large quantities to the above fluids (the two being well mixed) for twenty-four hours, and then inoculating guinea-pigs with them (spores and antiseptic). The animal died with symptoms of typical anthrax, the blood teeming with the *B. anthracis*.[1]

The very definite evidence from various sources, a portion of which will be given below, as to the power of mercuric chloride to destroy the spores of anthrax in much weaker solutions than that used by Klein, and in a much shorter time, justifies the suspicion that these guinea-pigs died from accidental inoculation with spores not subjected to the action of the disinfectant. This suspicion is further justified by Klein's account of the frequent accidents of this kind which have occurred in his laboratory. Among other examples of this, given in the work already referred to, is the following:

Another gentleman working in the laboratory of the Brown Institution intended to inoculate several guinea-pigs with human tubercles. For this end he mashed up in a saline solution, in a clean mortar, a bit of human lung studded with tubercles. He did this in my room on the same table on which I was working with anthrax. One of these guinea-pigs, inoculated with human tubercle, died before the second day was over of typical anthrax. Its blood was teeming with the *B. anthracis*. Such an accidental anthrax in guinea-pigs inoculated with tubercle occurred several times. * * * I myself had the following accidental contaminations: * * *[2]

[1] Op. cit., p. 253.

[2] Micro-organisms and Disease. *The Practitioner*, London, Aug., 1884, p. 110.

We are not here directly concerned with the restraining influence of mercuric chloride upon the development of anthrax spores, but having made some recent experiments in this direction which fully confirm the results previously reported by Koch, I may be excused for referring to the matter, especially in view of the therapeutic and sanitary possibilities which suggest themselves in connection with this inhibiting action of corrosive sublimate in very dilute solutions. From a sanitary point of view, it is evident that an agent which is capable of preventing the development of disease germs in cesspools and privy-vaults in the proportion of 1 : 300,000 (*i. e.*, one pound costing fifty cents would inhibit the development of anthrax spores in 300,000 pounds of a suitable culture-fluid) has an interest for health officers quite independent of the interest which attaches to it as a potent gemicide in stronger solutions.

Experiment, December 22, 1884. Mercuric chloride was added to a sterilized culture-fluid in the proportion of 1 : 100,000, 1 : 200,000, and 1 : 400,000, and two culture-flasks were filled from each solution. These flasks were then inoculated with anthrax spores from a pure culture, and another flask, not containing the mercuric chloride, was inoculated to test the stock. At the end of twenty-four hours the last mentioned flask contained an abundance of anthrax filaments: the others remained clear. At the end of forty-eight hours the two flasks containing the bichloride in the proportion of 1 : 400,000 contained flocculi of anthrax filaments, and the others remained clear.

Davaine found that the virulence of serum containing anthrax bacilli, obtained from the subcutaneous cellular tissue of an animal recently dead, is destroyed by adding to it corrosive sublimate in the proportion of 1 : 150,000.[1] In this case no spores are present in the material.

The restraining power of this agent is not so great for the spores of *B. subtilis* as for those of anthrax. This was shown by an experiment made upon the same date as that above reported. At the end of twenty-four hours after inoculation with spores, a mycoderma of *B. subtilis* had formed in solutions containing 1 : 100,000; and in forty-eight hours the same results had occurred in two flasks containing 1 : 50,000.

The inhibiting power of this agent is still less for micro-organisms in active multiplication. Thus, in my experiments reported in the *Am. Journal of the Med. Sciences*, April, 1883, the development of micrococci was prevented by 1 : 30,000 to 1 : 40,000. I have recently repeated these experiments with a similar result. To destroy the vitality of the same micrococci, as proved by their failure to grow in culture-fluids, required 1 : 20,000, while the bacteria in broken-down beef tea containing spores were destroyed by 1 : 10,000. According to Koch, mercuric chloride, in the proportion of 1 : 1,000, destroys all spores in a few minutes; and in weaker solutions, up to 1 : 10,000, he has shown by culture and inoculation experiments that this agent destroys the vitality of anthrax spores.

[1] "Recherches sur le traitement des maladies charbonneuses chez l'homme." Bulletin de l'Acad. de Med., 17 Juillet, 1880, p. 557.

The results of his culture and inoculation experiments are not, however, entirely in accord; and it seems probable that failure to develop upon the surface of a solid culture-medium, after ten minutes' exposure to 1 : 20,000, may have been due to the restraining influence of a small amount of bichloride not removed by the washing in alcohol, which was resorted to for the purpose of getting rid of this complication. Fluid-cultures possess an evident superiority for such experiments as this; for when a very small quantity of spore-containing material is introduced into flasks containing a large quantity of culture-fluid, the disinfecting agent is diluted beyond any possibility of interfering with the success of the experiment. Moreover, when spores fail to develop in such fluid-cultures it is easy to prove that the failure relates to loss of vitality on the part of the spores, and not to the presence of an inhibiting agent. This I am in the habit of doing by inoculating the same culture-fluid with other spores not disinfected; and the rapid development of these is satisfactory evidence that in the first experiment failure to develop was not due to the small amount of mercuric chloride introduced in the inoculation with disinfected spores.

The view, that in Koch's surface-cultures the inhibiting influence of the bichloride came into play, is sustained by his own inoculation experiments, and by my culture experiments reported below. Thus we are informed[1] that three mice were inoculated with anthrax spores, attached to strands of silk thread which had been exposed for ten minutes to solutions of the strength of 1 : 10,000, 1 : 20,000, and 1 : 50,000. All of the mice died of anthrax; but while the one inoculated with the strand exposed to 1 : 50,000 died in the usual time,—on the second day,—the one inoculated with 1 : 20,000 did not die until the fourth day, and the one with 1 : 10,000 not until the fifth day.

That anthrax spores may survive exposure to a solution of 1 : 10,000 for a longer period than ten minutes is also shown by the following experiments.

December 18, 1884. A *small quantity* of a culture-fluid containing anthrax spores was exposed for *one hour* to mercuric chloride in the proportion of 1 : 10,000. No development of anthrax bacilli occurred in a culture-flask inoculated with these spores; but in another experiment, made at the same time, in which the proportion of the disinfectant and the time of exposure remained the same, and in which a *much larger quantity* of the spore-containing culture-fluid was used, there was an abundant development of anthrax bacilli in the inoculated culture-flask.

It is evident that in this experiment a material change in the conditions was made, although the time of exposure and the amount of the disinfecting agent present were the same in both cases, and that in experiments of this kind the amount of material to be disinfected must also be taken into consideration. In other words, a few germs may be destroyed by a comparatively dilute solution of the disinfecting agent, while stronger solutions will be required for the destruction of a large number of germs

[1] *Mitth. a. d. k. Gesundheitsamte*, I, p. 277.

contained in the same amount of material. Again: It is true of mercuric chloride as well as of oxidizing disinfectants, such as potassium permanganate and the hypo-chlorites, that the quantity of non-living organic material present will also materially influence the result. This is illustrated by my experiments reported below, in which semi-solid feces was the material subjected to the action of the disinfectant.

The spores of *B. subtilis* are destroyed by about the same proportion of mercuric chloride as is required to kill anthrax spores.

Experiment, December 22, 1884. A small amount of a culture-fluid containing the spores of *B. subtilis* was exposed to the action of a solution of corrosive sublimate of the strength of 1 : 10,000 for thirty minutes. A like amount was exposed for one hour, and a third portion for two hours. Two culture-flasks were inoculated with spores from each. At the end of twenty-four hours those inoculated with the material exposed for thirty minutes showed an abundant development of *B. subtilis*, and the others remained clear.

The importance of the time of exposure to the action of the disinfecting agent, which is clearly brought out in the above experiment, is very well illustrated by the experiments on vaccine virus reported by Dr. W. J. Miller, of Dundee:

> I have made fourteen observations with this agent on vaccine. In one of these it was tested in the following manner: I placed half the contents of a well filled tube on a glass slide, and after it dried covered it with some perchloride solution (1 in 1,000), and after allowing it to lie for ten minutes washed off the perchloride gently with water, so that the film of vaccine remained. This was then rubbed up with water, and put in a tube for use. The product entirely failed to take, while the other half of the same specimen of lymph produced a good result. Another specimen was mixed with an equal quantity of the same solution (1 in 1,000), and was used an hour thereafter, disinfection being complete. Two trials were made with the same mixture prepared immediately before use, two after an interval of three minutes, and one after fifteen minutes, and in all five the lymph was uninjured. Five experiments were made with a solution of 1 in 500 and vaccine in equal proportions (=1 : 1,000.—G.M.S.), mixed respectively, immediately before use, a few minutes, three minutes, three minutes, and five minutes, and in all the lymph was in no way affected. Two observations with lymph and a still stronger solution (1 in 250), in equal proportions, mixed immediately before use, gave the same negative result.[1]

According to Arloing, Cornevin, and Thomas, the activity of dried virus of symptomatic anthrax is destroyed by mercuric chloride in the proportion of 1 : 5,000.

Jalan de la Croix found that the bacteria in beef *bouillon* were destroyed by 1 : 6,500, but that the proportion required to destroy bacteria in a beef infusion made without heat was 1 : 2,525.

It is evident, that in the absence of precise information as to the time of exposure and other essential conditions, these results cannot be compared directly with those reported by other observers, in which the material tested or the conditions of the experiment were different.

In the writer's experiments, reported in the *American Journal of the Medical Sciences* for April, 1883, the bacteria in broken-down beef tea

[1] *The Practitioner*, London, October, 1884, p. 265.

(old stock exposed in the laboratory for a long time) were destroyed by two hours' exposure to mercuric chloride in the proportion of 1 : 10,000, the amount of material exposed to the action of the disinfecting agent being comparatively small.

Extended experiments upon the disinfection of tuberculous sputum have been made by Schill and Fischer, and are reported in their paper published in the second volume of the *Mittheilungen aus dem Kaiserlichen Gesundheitsamte*. In these experiments the test of disinfection was failure of the material to produce tuberculosis when inoculated into susceptible animals.

In a first series of experiments with *dried* sputem, which had been kept for several months, a negative result was obtained in every case from the following inoculations: Two guinea-pigs inoculated with material exposed for twenty-four hours to 1 : 1,000; three with material exposed for twenty hours to 1 : 2,500; and three with material exposed for twenty hours to 1 : 5,000.

In another series of experiments with *fresh* sputum, in which the sublimate solution and the material to be disinfected were used in *equal amounts*, tuberculosis resulted in all of the test animals. Three of these were inoculated with material exposed for twenty-four hours to 1 : 2,000 (*i. e.*, equal parts of sputum and of a 1 : 1,000 solution), and three to material exposed for twenty-four hours to 1 : 1,000.

The failure to disinfect in these experiments was probably due to the fact that the viscid mass of sputum was not penetrated throughout by the disinfecting agent. In the successful experiment with dried sputum, the amount of material used was no doubt much smaller, and its physical condition (pulverized?) such as to insure the action of the disinfectant upon every portion of it.

In a previous paper[1] the writer has recommended the use of a solution containing 1 : 500 of mercuric chloride and 1 : 500 of potassium permanganate as an efficient disinfectant for sputum, and for the discharges of patients with typhoid fever and cholera. The experiments of Schill and Fischer, which I had not read when this recommendation was made, indicate that it will be necessary to use some other agent when the object in view is to destroy the infective virulence of tuberculous sputum; and in general it will no doubt be better to use an oxidizing disinfectant, such as the hypochlorite of soda, when the germs to be destroyed are imbedded in masses of albuminous material, for such masses are disintegrated and destroyed by oxidizing agents, whereas corrosive sublimate has the opposite effect, in consequence of its power of combining with and coagulating albuminous material. For liquid fecal discharges, however, our recommendation is sustained by the experimental evidence.

The following experiments have been recently made. The standard solution above referred to—mercuric chloride and potassium permanganate, of each 1 : 500—was diluted one half, and mixed with an equal quantity of broken-down beef tea (=1 : 2,000). After exposure for two hours,

[1] *The Medical News*, January 10, 1885, p. 34.

the contained germs had lost their vitality, as proved by culture experiments.

A more difficult test was the following: The standard solution was diluted one half, and mixed with semi-solid feces in equal quantity, well mixed by stirring. Two culture-flasks were inoculated from this at the end of thirty minutes, two more at the end of one hour, and two more at the expiration of two hours. One of the flasks, inoculated at the end of an hour, broke down; the others remained clear. In the case of the flask which broke down, it is probable that some little mass of material was introduced, which had not been thoroughly penetrated by the disinfecting agent. When the standard solution was diluted with three parts of water, and added to an equal amount of broken-down beef stock (=1 : 4,000), two hours' exposure failed to prevent the subsequent development of the contained spores in a sterilized culture-fluid.

The experimental data herein recorded seem to justify the following conclusions:

Mercuric chloride, in aqueous solution, in the proportion of 1 : 10,000, is a reliable agent for the destruction of micrococci and bacilli in active growth not containing spores; and in the proportion of 1 : 1,000 it destroys the spores of bacilli, provided that the micro-organisms to be destroyed are fairly exposed to its action for a sufficient length of time.

A standard solution of 1 : 1,000 may be safely recommended for the disinfection of bedding and clothing which can be washed; for washing the floors and walls of infected apartments; for disinfecting the hands and instruments of surgeons and gynecologists; and as a disinfecting wash for superficial wounds or mucous surfaces. For continuous application to wounds, etc., a solution of 1 : 10,000, or less, should be effective.

A standard solution of 1 : 500, with the same quantity of potassium permanganate, may be safely recommended for the disinfection of liquid fecal discharges, and other fluid material supposed to contain "disease germs," provided the time of exposure is not less than two hours, and the quantity of material to be disinfected is not in excess of that of the standard solution used.

CONSIDERATIONS CONCERNING THE PRACTICAL USE OF MERCURIC CHLORIDE AS A DISINFECTANT.

BY VICTOR C. VAUGHAN.

Since mercuric chloride has been put forward as one of the most reliable disinfectants, its practical use has been largely discussed, and some supposed dangers in its general employment have been brought forward. It was for the purpose of ascertaining how much truth there may be in these statements that the following experiments were undertaken.

Is there danger of the passage of this highly poisonous salt, from cesspools and privy vaults in which its use has been recommended, through

the soil into wells? Sanitarians have had so much to say about well-water being poisoned by the filtration of organic matter through the soil from privy vaults and cesspools, that it is not surprising that the above question should be asked. In order to answer it, the following experiments were made:

Experiment 1. A large glass funnel, carrying a filter-paper, was filled with gravel taken from a distance of about four feet beneath the surface. The weight of the gravel was eleven and three fourths pounds, and, when placed in the funnel, it formed an inverted cone, with a base of ten inches diameter and an altitude of eight inches. On this was poured one pint of standard solution No. 2 (corrosive sublimate and permanganate of potash, two drachms of each to the gallon of water), recommended for the disinfection of excreta. After a few minutes a pint of distilled water was also filtered through the soil. This was done in order to wash through any mercury that might be held mechanically in the gravel. The filtrate was collected, concentrated to one fluid ounce, and tested for mercury. The result was negative. The soil retained all of the poison.

Experiment 2. This was similar to the above, but black loam was used instead of the gravel. The weight of the soil used was seven pounds. The result was the same as with the gravel.

Experiment 3. In this instance clay was used. The weight of the clay was nine and one fourth pounds. As the soil in this case was very dry, it was thoroughly moistened with water before the solution of mercuric chloride was poured on.

These experiments show that the quantities of the different soils, as given above, will remove from solution and retain all the mercury contained in one pint of standard solution No. 2, fifteen grains of mercuric chloride. That a much smaller amount of soil would accomplish the same result was shown by the following:

Experiment 4. One and one half pounds of gravel were placed on the filter, and one pint of standard solution No. 2, one ounce at a time, was filtered through the gravel. The filtrate contained no mercury. From these experiments it will be seen that the fear that mercuric chloride may filter through the soil, when used as a disinfectant in privy vaults and cesspools, into wells, and thus poison the water, is groundless. Of course, where there is open connection between the cesspool and wells by the formation of small subterranean rivulets, there would be danger. The fixation of mercury in the soil is doubtless largely, if not wholly, due to the presence of certain inorganic salts, such as carbonates and phosphates, which form insoluble compounds of mercury.

At the recent cholera conference at Rome, Dr. Koch gave, as one of his reasons for not recommending mercuric chloride as a disinfectant, the belief that its disinfecting action was interfered with by the fact that it entered into combination with albuminous material, and thus failed to come in contact with germs enclosed in albuminous masses.[1] That a

[1] *The Medical News*, June 20, 1885, p. 707.

combination between the mercury and albumen does occur may be shown by the following very simple test:

Experiment 5. Suspend some recently precipitated mercuric oxide in distilled water, add some egg-albumen, agitate thoroughly, and filter. The filtrate is clear and colorless. Boil this filtrate with potassium chlorate and hydrochloric acid until all the organic matter is destroyed. Then test for mercury with hydrogen sulphide or stannous chloride. The mercury will be found to be present, and all that which was used as mercuric oxide can be recovered.

Albumen dissolves the oxide, forming, probably, mercuric albuminate; but there is no reason for believing that the mercuric albuminate does not diffuse through organic matter. As shown in the experiments, it is freely soluble, and readily passes through the filter-paper. It is altogether probable that it is this mercuric albuminate which forms such a powerful germicide. In this compound we have the mercury in the shape in which it would most likely be taken up by those lower forms of life which feed upon albuminous material.

Medical men have for a long time regarded "yellow wash" as the most successful application that could be made to syphilitic sores. Is it not likely that its great value is due to the formation of mercuric albuminate, which has a local action on the virus, and penetrates the tissue as well? A substance which is not absorbed by living organisms is not poisonous to them, and if by the formation of this mercuric albuminate the most readily absorbable form of mercury is secured, its poisonous properties are intensified.

Further considerations concerning the use of mercuric chloride will be presented as soon as some additional experiments are made. The writer is indebted to two of his students, Messrs. Wagner and Bobb, for aid in the experimental work.

ACTION OF MERCURIC CHLORIDE ON LEAD PIPES.

When a solution of mercuric chloride comes in contact with lead, there is an immediate deposit of mercury with the formation of lead chloride. That this action rapidly destroys lead pipe is shown by the following:

Experiment. One foot of one half inch lead pipe was placed in a tall beaker, and 1,000 c. c. of a two per cent. solution of mercuric chloride poured into the beaker. Instantaneously a white cloud of lead chloride formed around the pipe, and gradually subsided to the bottom. Each day the solution of mercuric chloride was changed, and the pipe washed with water. After 4,000 c. c. of the mercuric chloride solution had been used, the pipe had worn away to such an extent that on bending it the pipe would break.

Since the reaction is instantaneous, the result would practically be the same, though a little slower, with the solution of mercuric chloride flowing through the pipe.

Notes by Dr. G. M. Sternberg, chairman of committee:

I have recently made some experiments to determine the antiseptic power of mercuric oxide. In the proportion of 1:1,000 it has prevented any development of micro-organisms in veal broth, inoculated with two or three drops of broken-down beef tea. In

the proportion of 1 : 2,000 and 1 : 4,000, it restrained development for a time, but at the end of forty-eight hours the broth became clouded near the surface, and at the end of seventy-two hours had broken down completely. (The same culture-fluid broke down in twenty-four hours when not treated with an antiseptic.) This very decided antiseptic power shows that mercuric oxide is far from being "inert" from a biological point of view.

Disinfecting and Antiseptic Powder. The powder under this name, for which a formula was given in the Preliminary Report of the Committee on Disinfectants, was withdrawn in a letter published in the *Medical News* of May 2d.

The writer was responsible for this powder, and withdrew it because of the fact that mercuric chloride is decomposed by the hypochlorites in the presence of moisture. In the powder, made as directed, this reaction does not occur, and the keeping properties of the powder are all that could be desired. But when water is added to it the reaction occurs, and the yellow oxide of mercury is precipitated. This fact having been brought to my attention, I hastened to withdraw my recommendation of the powder, although I had been much pleased with it in practical tests upon feces. Since my return from Europe I have made some additional experiments, which show that, notwithstanding the destruction of the bichloride, the powder is an excellent disinfectant and antiseptic. A sample which I have recently examined contained 2.6 per cent. of available chlorine after the precipitation of the yellow oxide by the addition of water. This same sample, after standing in an open box in the laboratory for about three weeks, still contained 1.5 per cent. of available chlorine at the bottom of the box, and 1 per cent. at the surface of the powder, which had been exposed to the air during this time. I have demonstrated, by recent experiments, that mercuric oxide is a valuable antiseptic. In the proportion of 1 : 2,000 it retards the development of micro-organisms in beef tea inoculated with two or three drops of broken-down stock; and in the proportion of 1 : 1,000 it entirely prevented development for a week, the duration of the experiment, while in the comparative test the beef tea broke down in less than twenty-four hours. Nevertheless, I do not endorse the formula which I first recommended, for the reason that mercuric oxide has an antiseptic power inferior to that of the bichloride, and it is a waste of material to use the bichloride of mercury in the same formula with the hypochlorites. I would therefore recommend that the powder be made without the addition of mercuric chloride.

My object is to dilute the chloride of lime so that it may be used more economically, *especially upon the surface of fecal matter in privy-vaults.* Such a powder is especially needed in country places, where the old-fashioned open privy-vaults are in use, and in garrisons and military encampments.

Chloride of lime, as received from the manufacturers, is more or less lumpy, and cannot be readily scattered about in a uniform manner. It is also much stronger in chlorine than is necessary. I have therefore endeavored to find an inert substance suitable for diluting it.

Plaster of Paris has the advantage of retaining the chlorine better than anything else I have tried, and makes a powder which can be readily scattered about in a thin layer. Its property of setting with water is no objection to its use in privy vaults, cess-pools, etc., but would be an objection to its use in chamber vessels, the contents of which were to be thrown into water-closets.

To test the keeping properties of a mixture of chloride of lime and sulphate of lime, mixed together in equal quantities, by weight, I exposed a layer having a thickness of about one and a half inch in a shallow vessel, and for comparison, a mixture of equal parts of chloride of lime and sand in a similar vessel. At the outset of the experiment the available chlorine in each specimen was found by Dr. Abbott to be 15 per cent. At the end of a week the mixture with plaster contained 12.9 per cent. of available chlorine, and the mixture with sand 6.8 per cent. At the same time two fruit jars were filled about one third full with the two mixtures, and the metal covers were screwed on. In these closed jars the mixture with sulphate of lime contained 13.5 per cent. of available chlorine at the end of two weeks, and the mixture with sand 11.8 per cent.

THE COMPARATIVE ANTISEPTIC VALUE OF THE SALTS AND OXIDES OF MERCURY.

BY GEORGE M. STERNBERG.

In the introduction of this report the statement is made that "a complete investigation of both disinfectants and antiseptics being impracticable in the time and with the resources at command, the committee decided upon so far departing from the letter of the resolutions of Dr. Hibberd as to limit its inquiry altogether to disinfectants, and to omit all investigations into the action of antiseptics."

The present article is the result of a departure from this rule which the writer has made with reference to the salts and oxides of mercury, because of the special interest which they have from a therapeutical point of view, and because of the important indications which seem to be furnished by their antiseptic power for restricting the development of pathogenic organisms in the alimentary canal, as well as in masses of decomposing organic material which might serve as pabulum for disease germs external to the body.

With the assistance of Dr. Abbott, I have recently made a series of experiments, the results of which are given in the following table:

	Active.	Failed.
Biniodide of mercury,	1:20,000	1:40,000
Bichloride,	1:15,000	1:20,000
Protiodide,	1:10,000	1:20,000
Yellow oxide,	1: 1,000	1: 2,000
Black oxide,	1: 500	1: 1,000
Calomel,		1: 100
Blue mass,		1: 100

In every case the antiseptic was carefully weighed and added to 100 c. c. of beef-peptone solution, or of veal broth. A similar quantity of the culture-fluid was put up as a *temoin* without the addition of the antiseptic. As the oxides and iodides of mercury are insoluble in water, the bottle was repeatedly shaken in order to dissolve in the albuminous culture-fluid as much of the antiseptic as possible. An undissolved remnant could, however, be recognized at the bottom of the bottle after this repeated shaking. Two drops of broken-down beef stock were added to each bottle to cause speedy putrefaction of the culture-fluid in the absence of a sufficiently potent inhibition of the developing power of the bacteria of putrefaction. In every case in the comparative experiment the culture-fluid became clouded, and had a putrefactive odor at the end of twenty-four hours.

The first column in our table shows the proportion in which the culture-fluid was preserved from any appearance of decomposition for at least a week, the duration of the experiment. In the proportion given in the second column a decided inhibiting power was shown, except in the case of calomel and blue mass, which, in the proportion given (1:100), gave no evidence of antiseptic power. The other salts and

oxides in the list prevented decomposition for twenty-four hours in the proportion given in the second column; and it was not until the second day that the bacteria of putrefaction commenced to form a cloud at the upper surface of the fluid, which gradually extended until the fluid had entirely broken down, usually by the third or fourth day. The bottles containing the biniodide (1 : 20,000), and the bichloride (1 : 15,000) have now been standing in the laboratory for three weeks, and are as transparent and free from odor as the day they were put up. These results agree with those reported by Miquel.

So far as I know, the antiseptic value of the protiodide and of the oxides of mercury has not heretofore been determined. I shall refrain at present from making any remarks upon the therapeutic possibilities which these figures suggest, or upon the possible explanation of the *modus operandi* of the protiodide, given daily for many months in the cure of syphilis, or of the use of yellow oxide as a remedy for septic fermentation in the alimentary canal. The still greater inhibiting power of mercuric chloride for the spores of *B. anthracis* has already been referred to in the paper published on page 227 of this report.

SULPHUR DIOXIDE.

BY GEORGE M. STERNBERG.

Vallin, to whom we are indebted for the best practical "treatise upon disinfectants and disinfection"[1] which has yet been published, says,—

"Sulphurous acid, obtained by the combustion of sulphur in free air, occupies almost the first place among the veritable disinfectants."[2]

This is the deliberate judgment of one who had carefully considered the experimental evidence accessible at the time this opinion was formulated (1882).

The use of sulphurous acid gas as a disinfecting agent has come down to us from remote antiquity, and it is safe to say that no gaseous disinfectant known is more extensively used, or has a higher place in the confidence of leading sanitary authorities at the present day. So well established is the belief that the fumes of burning sulphur will destroy the infection of small-pox, scarlet fever, yellow fever, etc., that it is probable that many believers in the germ theory of disease would be disposed to abandon this belief rather than to give up their faith in the disinfecting power of sulphurous acid gas, in case the experimental evidence relating to the germicide power of this agent should be in conflict with the results of their experience.

It is the object of the present paper to present the experimental evidence for the consideration of sanitarians, and, as the subject is one of

[1] E. Vallin, Médecin Principal de 1re Classe de l'Armée, Professeur d'Hygiene a l'ecole de Méd. Militaire du Val-de-Grace, etc. Traité des Désinfectants et de la Désinfection, Paris, 1882.

[2] Op. cit., p. 243.

great practical importance, the paper will necessarily be one of considerable length.

Before the modern methods of isolating and cultivating pathogenic micro-organisms had been perfected, various efforts had been made to determine by experiment the disinfecting power of sulphurous acid gas. One of the first of these experiments upon record is that which the Russian physicians are said to have made at the time of the pest in Moscow, in 1771. According to Dr. A. Wolff, ten cloaks *(pelisses)* which had been worn by soldiers seized with the plague, during their sickness, were exposed to fumigation *(une forte fumigation)* with sulphur and saltpetre. Ten criminals, condemned to death, were then required to wear these garments, and not one of them contracted the malady. In the absence of any control-experiment in which similar garments not disinfected were proved to communicate the disease, we cannot admit that disinfection was accomplished in this instance, as claimed by the Russian physicians, by the fumigation resorted to. The same criticism may be made with reference to most of the evidence relied upon at the present day, which is supposed to establish the value of the agent in question. It is negative in character, and we have no control-experiments. Moreover, accompanying or following the fumigation, other measures are commonly adopted, such as free ventilation and cleansing of apartments, exposure of clothing and bedding to an abundance of fresh air, etc. As in clinical experiments a fictitious value is often assigned to remedies by reason of the failure of the experimenter to recognize the influence of the *vis medicatrix naturæ*, so there is reason to believe a "disinfectant" may often establish a temporary reputation at least, upon the real virtues of an abundance of fresh air, together with a free use of hot water and scrubbing brushes, with perhaps a judicious use of the whitewash brush in addition. These remarks are made, not to throw discredit in advance upon the agent under consideration, but with a view to showing that a careful survey of the experimental evidence is necessary, and that a spirit of scientific conservatism is required when the attempt is made to estimate the value of negative evidence in a case of this kind.

In vaccine virus we have an infectious material which seems especially well adapted as a test of disinfecting power, and the inference seems justified that an agent which will destroy the specific virulence of this material may also be relied upon for the destruction of the small-pox infection. The writer applied this test in a series of experiments made in 1880 and 1881, and published in the *Bulletin* of the National Board of Health. The results obtained have been summarized by Vallin, and, as his work is before me, I quote from it as follows:

Dougal and Baxter have shown the neutralizing power of sulphurous acid upon different kinds of inoculable virus. Both exposed for ten minutes, in an atmosphere saturated with sulphurous fumes, ivory points charged with dry vaccine virus. At the end of this time the neutralized virus was inoculated by three punctures in the arm of a non-vaccinated infant, while in the other arm, at the same time, three punctures were made with ivory points charged with the same virus, but not exposed to sulphurous acid. The last-

mentioned punctures were all followed by perfectly developed vesicles; the punctures upon the other arm gave no result. Unfortunately the quantity of the acid, or of sulphur burned, is not mentioned. This time, by exception, Baxter leaves us in doubt.

Dr. Sternberg, surgeon in the United States Army, has taken up these experiments in an ingenious manner, and with greater precision. This author burned a determined quantity of sulphur in a wooden box having a capacity of ten litres. He submitted to the vapors thus produced liquid vaccine virus, placed in a watch-glass, for a period of twelve hours. The following day unvaccinated infants were inoculated in one arm with the disinfected virus, and in the other with a portion of the same virus not exposed to the disinfectant.

Liquid virus thus exposed for twelve hours to the action of the fumes from 3 centigrammes of sulphur burned in the air-chamber—that is, 24 cubic centimetres of gas to 10 litres of air, or a little more than two parts in a thousand—produced but a single vesicle, while the non-disinfected virus in the other arm gave a successful result in every instance. Upon doubling the amount of sulphur,—that is, 6 centigrammes to 10 litres, or 6 grammes per cubic metre, or 5 volumes of sulphurous acid to 1,000 volumes of air,—and reducing the time of exposure to four hours, the vaccine still remained inactive after exposure.

It suffices, then, to burn 5 grammes of sulphur in a cubic metre of air, in order to neutralize *liquid* vaccine, but this vaccine coagulates almost immediately upon contact with sulphurous acid gas; and this contributes, perhaps, to destroy, or to modify, its inoculability. We shall see, further on, that experiment made in spaces of such small dimensions may lead to grave errors.

In order to disinfect dry vaccine, Sternberg found that a considerably larger quantity of sulphur was required, viz., 16 grammes per cubic metre, which corresponds with the classical proportion of 1 volume of sulphurous acid gas to 100 volumes of air. In this regard the experiments of Sternberg confirm those which have been obtained by many other authors.

Baxter has also tested the power of an aqueous solution of sulphur dioxide to disinfect the virus of glanders, and an infectious form of septicæmia—induced—in guinea-pigs. Four parts of SO_2 by weight, added to 1,000 parts of the diluted virus of glanders, neutralized its infective properties, as determined by inoculation experiments. The septic virus was destroyed by 3 parts by weight in 100, while 6 in 1,000 failed. The time of exposure to the disinfectant in these experiments is said to have been from thirty minutes to three hours; but this is considered by Baxter to be a matter of secondary importance, and, according to him, disinfection is complete at the end of five minutes, when the virus has been intimately mixed with the disinfecting solution.

The wide limits (3 : 100 and 6 : 1,000) between success and failure in these experiments of Baxter, and an evident want of precision in the conditions, especially as to time, induced Vallin, from whom we have quoted the above results, to undertake additional experiments with the virus of glanders. He says,—

I had, in January, 1881, an opportunity to repeat these experiments. A patient in the service of our colleague, M. Gaujat, at Val de Grace, was attacked with glanders,—*abces farcineux multiples*,—and furnished an inoculable pus, with which Dr. Kiener produced in several animals—guinea-pigs, cats, etc.—the characteristic lesions of glanders. A small quantity of this pus obtained directly from the patient, and placed in a watch-glass, was exposed for twelve hours in a wooden box having a capacity of exactly 100 litres. Two grammes of sulphur were burned in this box,—an amount which corresponds with 20 grammes per cubic metre. The following day a guinea-pig was inoculated with the disin-

fected virus. At the end of three months this animal remained in perfect health. Another guinea-pig, inoculated the same day with a second portion of the same virus preserved between two watch-glasses, and not disinfected, died at the end of two months with the characteristic lesions of glanders.

Additional experiments were made with the same virulent pus dried in the open air upon little squares of flannel. Inoculation with this material failed after exposure to sulphur dioxide generated by burning sulphur in the proportion of 15 grammes per cubic metre. But inoculation with the desiccated virus not exposed to a disinfecting agent also failed, and Vallin remarks that desiccation alone had perhaps sufficed to destroy the virus, as in the experiments of Galtier. Experiments were also made with pus obtained from a tuberculous abscess in a case of Pott's disease. This material was divided into two portions, and placed in watch-glasses. One portion was subjected for twelve hours to the action of sulphur dioxide generated by burning sulphur in the proportion of 20 grammes per cubic metre. This pus, injected subcutaneously into a guinea-pig, produced no result. At the end of four months the animal remained in good health. The non-disinfected pus injected into another guinea-pig caused its death on the forty-eighth day. Its liver, spleen, lungs, and peritoneum were filled with tubercle granules. Other experiments were made with pus obtained from two chancres "of doubtful nature." Inoculation with this material, after exposure to SO_2 (15 grammes of sulphur per cubic metre of space), gave no result, while the non-disinfected pus produced "characteristic pustules."

In the experiments thus far recorded, the disinfecting power of the agent under consideration is fully established for certain kinds of material, and especially for vaccine virus. In my own experiments upon this material the results were extremely definite, and the conditions observed were such as to render them unimpeachable. Experiments upon original virus from various sources are especially valuable from a practical point of view, inasmuch as the results obtained are evidently reliable guides with reference to the destruction of infective virulence in the several kinds of material experimented upon, and this without regard to any theory as to the nature of the morbific agent. We know, however, that in several infectious diseases at least, this agent is a living organism or germ. It is therefore a matter of importance to determine the exact germicide power of this and other agents which have been proved to be useful disinfectants, and numerous experiments have been made with this object in view. If the germ theory of disease is correct, as applied to all infectious diseases, there should be a correspondence between the results obtained in experiments with original virus and those made upon pure cultures of the pathogenic organism to which such virus owes its infecting power. This is an interesting question in connection with the agent under consideration, inasmuch as Wernitz has shown that sulphurous acid promptly neutralizes the action of non-living ferments in comparatively small amounts, and there is therefore ground for the supposition that the specific disease poisons destroyed by this agent in the disinfection experiments above recorded were of this nature.

According to Wernitz,[1] the action of pepsine, of ptyaline, of invertine, and of diastase, is prevented by the presence of an aqueous solution of SO_2 of 1 : 1317 to 1 : 860 (by weight); while the action of myrosine and of emulsine is neutralized by 1 : 21,000.

Wernich, of Breslau, experimenting in the Pathological Institute of Berlin, 1877, saturated strips of woollen or cotton goods with putrid liquids, and exposed them under a bell-jar containing a definite proportion of sulphurous acid gas. Then, with proper precautions, these strips were introduced into tubes containing Pasteur's culture solution, thoroughly sterilized. The development of bacteria in this fluid was taken as evidence that disinfection was not complete. The results obtained are summarized by Vallin[2] as follows:

When the strips of material were suspended for several hours under a bell-jar containing 3.3 volumes of sulphurous acid per 100 volumes of air, they were not disinfected. When the proportion of gas was increased to 7 per cent., or even to 4 per cent., the time of exposure being six hours, the strips of goods no longer fertilized culture liquids.

Schotte and Gärtner,[3] in 1880, experimented also upon the bacteria of putrefaction. In a chamber having a capacity of 40 cubic metres they placed, at various levels, shallow dishes containing culture liquids, into which putrefactive bacteria were introduced. Sulphur was burned in earthen vessels, placed about four feet above the level of the floor. When the amount burned was in the proportion of 15 grammes per cubic metre of space—an amount which gives one volume of SO_2 to 100 volumes of air—it was found that at the end of six hours the gas had escaped to such an extent that it was possible to enter and remain in the room, although during the entire time the doors and windows had been carefully closed. The result of the experiment was, that the culture liquids exposed in the upper part of the chamber remained clear, while those placed upon the floor broke down at the end of from twenty-four to thirty-six hours. When the amount of sulphur burned was increased to 28 grammes per cubic metre (about two volumes per cent. of SO_2), disinfection was complete. When the culture fluids were placed upon the shelves of a cupboard, "half closed," and situated in the corner of the chamber, disinfection was only obtained by burning 92 grammes of sulphur per cubic metre of space.

We remark that the test of disinfection was not satisfactory in these experiments. A certain amount of SO_2 was, no doubt, absorbed by the exposed culture liquids; and these, in successful experiments, failed to break down, because of the antiseptic or restraining influence of this agent. But, to prove that the germs of putrefaction in these culture liquids were killed, it would have been necessary to inoculate fresh cultures with a small amount of this material which had been exposed to the action of a disinfectant.

[1] I. Wernitz, *Ueber die Wirkung der Antiseptica auf ungeformte Fermente*, Dorpat, 1881.

[2] Op. cit., p. 234.

[3] Viertelj. f. Oeff. Gesund., 1880, t. xii, pp. 337–376.

Other experiments were made by the authors named, which we shall quote in the language of Vallin:[1]

Strips of very thick woollen goods were soaked in culture liquids containing bacteria. These were dried, a proceeding which did not destroy the vitality of the bacteria, as proved by culture experiments. These strips were suspended from a cord stretched across the middle of the chamber at a level of about five feet above the floor. Half of the strips were left dry; the other half, after having been dried, were again moistened, so that they might be exposed in a moist condition to the sulphurous vapors. Our authors arrived at the following unexpected results: Even after having been exposed to the action of sulphur dioxide, produced by the combustion of 92 grammes of sulphur per cubic metre, the moistened strips caused culture liquids, in which they were placed, to break down at the end of three or four days. The dry strips exposed in the same way produced the same results somewhat sooner—*dans le 3e jour.* Gärtner and Schotte have concluded from this that the germs, or proto-organisms, hidden in the deeper portions of the very thick woollen goods, resist strong fumigations with sulphurous acid gas, or with other disinfectants. They arrive almost to the point of doubting the possibility of a certain and absolute disinfection, at least by the gases or vapors.

The limits of this paper admit only of a brief abstract of the elaborate experimental researches relating to the value of sulphur dioxide as a disinfectant, made by Koch[2] and by Wolffhügel,[3] under the auspices of the Imperial Board of Health of Germany, and published in the first volume of the *Mittheilungen aus dem Kaiserlichen Gesundheitsamte.*

The experiments of Wolffhügel relate to questions concerning the practical use of SO_2, the best methods of producing it, etc., while those of Koch are designed to fix its exact germicide value. In Koch's first experiments sulphur dioxide was generated by burning sulphur in a box having a capacity of 290 litres. Other experiments were made in a closed chamber. The amount of SO_2 present was estimated at the outset and at various intervals. Thus in his third experiment, in which the disinfection box was used, the amount of SO_2 was,—

At first,	6.13 vol. per cent.
At the end of 24 hours,	4.88 " "
At the end of 72 hours,	4.47 " "
At the end of 96 hours,	3.3 " "

In this experiment only spore-containing material was exposed in the disinfection box. This consisted of old dried milzbrand (anthrax) blood, anthrax spores dried upon silk threads, spore-containing earth, and hay bacillus spores dried upon blotting paper. The result was entirely negative: the developing power of the spores was not in any instance destroyed, even after ninety-six hours' exposure, and a mouse inoculated with the dried blood, exposed for this length of time, died promptly of anthrax.

The results obtained with material not containing spores were more satisfactory, but still not of a nature to give confidence in this agent as a reliable disinfectant for the purposes and in the manner it which it is commonly applied. The experiments show, in the first place, that it is not safe to apply the data obtained by burning sulphur under a bell-jar, or in a tight box of small dimensions, to disinfection on a large scale,

[1] Op. cit., p. 253.
[2] Op. cit., pp. 252–261.
[3] Ibid., pp. 188–233.

owing principally to the rapid loss of gas which occurs in an ordinary apartment, with all apertures carefully closed. Thus in Koch's fifth experiment in a closed chamber, the rapid loss of SO_2 is shown by the following figures:

At the end of half an hour, ...	3.12 vol. per cent.
At the end of 2 hours, ...	1.25 " "
At the end of 22 hours, ...	.015 " "

In Experiment No. 2, made in a box having a capacity of 290 litres, anthrax bacilli, without spores, from the spleen of a mouse recently dead, and dried upon silk thread, were destroyed by exposure for thirty minutes to SO_2 in the proportion of 1 vol. per cent.

In Experiment No. 7, also made in the box, the amount of SO_2 at the outset was .84; at the end of twenty-four hours, .55. An exposure of one hour in this experiment destroyed anthrax bacilli (still moist) upon silk thread. Four hours' exposure failed to destroy the vitality of *Micrococcus prodigiosus* growing upon potato, but twenty-four hours' exposure was successful. The same result was obtained with the bacteria of blue pus.

In Experiment No. 8, it was found that an aqueous solution of SO_2 of 11.436 per cent., by weight, did not destroy anthrax spores in twenty-four hours, but was successful in forty-eight hours. When the proportion of SO_2 was reduced to 5.718 per cent., disinfection was only accomplished after five days' immersion in the aqueous solution.

According to Arloing, Cornevin, and Thomas, sulphurous acid does not destroy the bacteria of symptomatic anthrax, which contain spores.

The experimental results thus far recorded will perhaps prepare those who have heretofore had implicit faith in the disinfecting power of sulphurous acid, to accept, without too much incredulity, the following results obtained by the writer in recent experiments with this agent:

At the request of Dr. William M. Smith, health officer of the port of New York, I visited that city on the 9th of January, 1885, for the purpose of applying biological tests in an experiment designed to ascertain whether it is practicable to disinfect rags in the bale. A manufacturing chemist of New York proposed to accomplish this by injecting sulphur dioxide into the interior of the bales through hollow tubes. The SO_2 had been compressed to the liquid form in copper cylinders, and being under a pressure of six atmospheres was expected to permeate the bale thoroughly when the valve was opened leading to the hollow and perforated screws introduced into it. The bale was to be placed in a closed chest of moderate dimensions, and disinfection was to be accomplished within a few minutes.

The experiment was made at the Baltic stores, Brooklyn, in the presence of Dr. Smith, health officer of New York; Dr. Raymond, commissioner of health of the city of Brooklyn; and several other gentlemen belonging to the health departments of New York and of Massachusetts.

The following material, which I had brought in sterilized tubes from the biological laboratory of Johns Hopkins University, Baltimore, was

introduced into the bale through openings made with a pocket knife. The depth of these openings was from two to four inches. The material to be disinfected was upon pledgets of cotton previously sterilized, which had been saturated with pure cultures of the various test-organisms. Some of these pledgets had been subsequently dried at low temperatures, others remained moist. The apertures in the bale were closed, after introducing these bits of cotton, by tamping in strips of old muslin. When these preparations had been made, the bale of rags was placed in the disinfection chamber, and the gas turned on. The time during which the gas was allowed to flow was three minutes and a half. The pressure, as shown by a gauge in connection with the copper cylinder, was eighty pounds at the commencement and seventy-five at the close of the experiment. The disinfection chamber was not tight, and all those in the vicinity were obliged to retire to a respectful distance to windward while the gas was flowing, and for a considerable time afterward, owing to the abundant escape and stifling effect of the SO_2. It was only after an interval of twenty or thirty minutes that the disinfection chamber could be approached to withdraw the bale; and after it had remained in the open air for some time, I was almost suffocated while removing the pledgets of cotton containing the test-organisms. These were at once placed, with sterilized forceps, in sterilized glass tubes, and each tube was at once plugged with sterilized cotton. In this way they were taken back to the laboratory in Baltimore, where the test of disinfection was completed by culture and inoculation experiments. The nature of the material and the results of the experiment are given in the following table:

Number of tube containing cotton pledget.	Nature of material.	Test by cultivation.	Result.	Test by inoculation.	Result.
No. 1.	*Bacillus anthracis* containing spores (dry).	One culture tube.	Abundant development of anthrax filaments in twenty-four hours.	One rabbit inoculated subcutaneously.	Died of anthrax on third day.
No. 2.	*Bacillus anthracis* containing spores (dry).	One culture tube.	Abundant development of anthrax filaments in twenty-four hours.	One rabbit inoculated subcutaneously.	Died of anthrax on third day.
No. 3.	*Bacillus anthracis* containing spores (moist).	Two culture tubes.	Abundant development in both.	One rabbit inoculated.	Survived the inoculation.
No. 4.	*Bacillus subtilis* spores (dry).	Two culture tubes.	Abundant development of *Bacillus subtilis* in both.		
No. 5.	*Bacillus subtilis* spores (moist).	Three culture tubes.	Abundant development of *Bacillus subtilis* in each.		

Other pledgets of cotton had been exposed in the bale, which had been saturated with tuberculous sputum ; but this part of the experiment was not followed up, owing to the scarcity of rabbits for inoculation.

Soon after my return to Baltimore, I received from the manufacturer, in New York, a copper cylinder, containing a liberal supply of SO_2 in liquid form. With this the following experiment was made, January 25, in a closet having a capacity of eight cubic yards. This closet, in the basement of the biological laboratory, had been constructed under the stairway as a refrigerating chamber. The walls were double, and filled in with asbestos ; and the door, made in the same way, was fitted to close as accurately as possible, and held closed by a strong clamp.

A sufficient quantity of the liquid SO_2 to produce ten volumes per cent., when volatilized in the closet described, was drawn from the copper cylinder into a large beaker, quickly placed upon the floor of the disinfection chamber, and the door closed. At the end of twelve hours the door was thrown open, and the gas permitted to escape. The test-organisms were exposed upon little pledgets of absorbent cotton, which had been saturated culture-fluids, containing the various micro-organisms employed. Some of these pledgets of cotton had been dried at a low temperature in advance of the experiment, and others were exposed moist.

Some of the prepared bits of absorbent cotton were placed in glass tubes, open at one end and sealed at the other. Other pledgets were loosely folded in a single thickness of heavy muslin, which had been sterilized by heat. The ends of these little packages were left open, so that the SO_2 might have free access to the interior. These packages, properly labelled, were placed in the inside pockets of a coat, and this was suspended in the closed chamber used for the experiment. The glass tubes were placed in an open pasteboard box upon the floor of the disinfection chamber. Other pledgets of cotton, similarly prepared, were wrapped up in little bundles of cotton, weighing half an ounce each, and enveloped in a single layer of sterilized muslin. Still other pledgets were wrapped up in a woollen blanket in such manner that they were in the centre of a compact bundle, eighteen inches long and ten inches in diameter. The result, as determined by cultivation experiments, was as follows :

Cotton pledgets exposed in glass tubes.

Micrococci from case of vaccinal erysipelas, moist and dry. No development from the moist material ; abundant development of micrococci from dry material.

Bacillus subtilis (spores), moist and dry. Abundant development of *B. subtilis* at end of twenty-four hours from both moist and dry material.

Bacillus anthracis (spores), dry. Abundant development of anthrax bacilli within twenty-four hours.

Cotton pledgets placed in coat pocket.

Micrococci from case of vaccinal erysipelas, moist and dry. Two culture-tubes inoculated from each. Abundant development of same micrococci within twenty-four hours.

Bacillus anthracis (spores), moist and dry. Two tubes inoculated from each. Pure cultures of *B. anthracis* obtained in each within twenty-four hours.

Bacillus subtilis (spores), moist and dry. Two tubes inoculated from each. At the end of twenty-four hours a mycoderma of *B. subtilis* was found upon the surface of the culture-liquid in each of these tubes.

The complete failure thus far made it useless to open the bundles of cotton and the rolled blanket, which were put aside for further experiments.

On the 1st of February a second experiment was made in the same disinfection chamber upon test-organisms prepared as before. In this experiment the conditions were changed by the introduction of steam into the chamber through a tube connected with a retort outside. Two litres of water were evaporated, and the steam passed into the chamber during the first four hours of the experiment. The amount of SO_2 in this experiment was increased to twenty volumes per cent.; the time of exposure was twelve hours; the result as follows:

Organisms exposed in coat pocket.

Coat suspended from wall, and pledgets of cotton loosely folded in filter paper, with ends of packages open for free admission of gas.

B. subtilis (spores), moist and dry. Abundant development in twenty-four hours in culture-fluids inoculated with the exposed spores.

B. Anthracis (spores), moist and dry. Abundant development of anthrax filaments in culture-tubes inoculated with this material.

Micrococci—pure culture—from blood drawn from inflamed area in a case of erysipelas. One moist and two dry pledgets. Pure cultures of this micrococcus were obtained from all of these after exposure in coat pocket as described.

Organisms exposed on pledgets of cotton in open tubes placed upon the floor of disinfection chamber.

B. subtilis (spores), dry and moist. Abundant development in culture-fluids.

B. anthracis (spores), dry and moist. Pure cultures obtained from exposed material.

Micrococci, from erysipelas (same stock as above), two pledgets, dry. Pure cultures obtained from both.

The complete failure to destroy the test-organisms under the conditions mentioned induced me to try the following experiment:

February 2.—Pure SO_2 in liquid form was poured into a tube (experiment in duplicate) containing spores of *B. subtilis* on dry cotton. The rapid volatilization of the liquid produced, of course, intense cold. As the tube was long and narrow, and volatilization was restrained by the low temperature, the time of contact with the SO_2 was at least ten minutes. The vitality of the spores thus brought in contact with the liquid SO_2 was not impaired, as shown by culture experiments.

The experiment was repeated February 5 with anthrax spores upon *moist cotton*. The result was the same. Anthrax filaments appeared in cultures inoculated with these spores at the end of forty-eight hours.

It was evidently useless to extend these experiments so far as spores are concerned; but the question remained as to the practicability of destroying pathogenic micrococci and bacilli without spores. As Koch has shown that the loss of sulphur dioxide is very rapid from a room which is carefully closed to prevent its escape, the following experiments were made in a gas-tight receptable:

February 2.—The following named test-organisms were placed under a bell-jar, having a capacity of one gallon. The jar was sealed below by resting in a trough containing mercury. Enough liquid SO_2 to make twenty volumes per cent. was introduced into this jar, and was, of course, quickly volatilized. The time of exposure was eighteen hours; results as follows:

Micrococci (pure culture) obtained from a case of vaccinal erysipelas (culture started from drop of blood drawn from inflamed area). One moist and two dry pledgets of sterilized cotton, previously saturated with this culture, were exposed in glass tubes open at one end; also a few drops of the culture-fluid poured into a similar tube. Result negative; disinfection was complete, as proved by attempt to start cultures from the exposed organisms.

Micrococci (pure culture) from blood of woman with puerperal septicæmia (fatal case). Exposed one pledget of cotton, moist, in glass tube, and a few drops of culture-fluid in the bottom of two other glass tubes; disinfection complete.

Micrococci (pure culture) from vaccine vesicle. Exposed two pledgets of cotton, moist, and one tube containing a few drops of pure culture; disinfection complete.

Micrococcus ureæ (pure culture in beef tea). Exposed one pledget of cotton, moist, and one tube containing a few drops of culture; disinfection complete.

Having determined by this experiment that SO_2, even in the absence of moisture, may kill micrococci, a second experiment was made to ascertain whether the quantity of the disinfecting agent could be reduced so as to bring it more nearly within practical limits.

February 7.—SO_2 was introduced under the bell-jar, as above described, and the following test-organisms exposed to its action for twenty hours:

Micrococci from vaccinal erysipelas.[1] Exposed two pledgets of cotton, dry, in glass tubes. From one of these, cultures of this micrococcus were obtained; cultures inoculated from the other remained sterile. Two pledgets of cotton moistened with a recent culture were also exposed. Cultures from these remained sterile. A few drops of a fresh

[1] The writer does not commit himself to the view that the micrococci from the various sources mentioned are specifically different, and the cause of the morbid phenomena in the individuals from whose blood the cultures were started, inasmuch as he has not been able to obtain any definite proof that such is the case. On the other hand, he admits that it is extremely probable that they are concerned in the development of these morbid phenomena, and are, in fact, pathogenic organisms.

culture placed in the bottom of a glass tube subsequently fertilized—sterilized culture-fluids—failed to disinfect.

M. ureæ, exposed upon two pledgets of cotton, moist; disinfection complete.

In the above experiment, the material to be disinfected was placed near the bottom of the jar. In the following experiment a taller jar, having a capacity of five litres, was used, and the test-organisms were exposed upon a shelf near the centre of the jar. As before, liquid SO_2 was introduced in an open beaker in a proper quantity to make four volumes per cent. The time of exposure was twenty-four hours.

Micrococci (pure culture) from vaccine vesicle, on cotton, moist; disinfection complete.

Micrococci, puerperal septicæmia, pure culture on cotton, moist; disinfection complete.

Micrococci, vaccinal erysipelas, pure culture on cotton, moist; failure to disinfect.

Micrococci, from vaccine vesicle, on cotton, dry, in duplicate; disinfection complete in one, failure in the other.

I have also tested the germicide power of an aqueous solution of SO_2 on the above-mentioned micrococci, with the following results:

February 5.—Equal parts of a recent culture of micrococci from vaccine vesicle, micrococci from case of puerperal septicæmia, and *M. ureæ*, were added to a standard solution of SO_2 containing five per cent. by weight. The time of contact was two hours, after which two culture-tubes were inoculated from each; no development occurred; disinfection complete.

February 7.—The standard solution of SO_2 (five per cent.) diluted to 1 : 50 was added, in equal portions, to a pure culture of the micrococcus from vaccinal erysipelas (making the dilution 1 : 100 = .05 per cent. of SO_2 by weight, or 1 : 2,000). Cultures inoculated after two hours' contact remained sterile. At the same time a solution of 1 : 100 was added to a culture of the micrococcus from a vaccine vesicle (*i. e.*, 1 : 4,000 by weight); in this case disinfection failed.

February 10.—The above experiment was repeated with the last-mentioned micrococcus with solutions containing 1 : 1,000, 1 : 2,000, and 1 : 4,000 of SO_2 by weight (after admixture with the culture-fluid).

The result corresponded with that previously obtained. Disinfection was accomplished by the solution of 1 : 1,000 and 1 : 2,000, but failed when the amount was reduced to 1 : 4,000.

February 11.—The same result was obtained with a recent culture of the micrococcus from case of puerperal septicæmia, *i. e.*, the standard solution of five per cent., when diluted with forty-nine parts (1 : 50) of distilled water, in two hours' time destroyed the developing power of this micrococcus, while the same solution diluted to 1 : 100 (1 : 4,000 of SO_2 by weight) failed to disinfect.

These results correspond with those reported by Jalan de la Croix, who found that one grain of SO_2 in 2,000 of bouillon filled with growing

bacteria causes development to cease, and destroys the vitality of these bacteria. When spores were present, however, it was necessary to increase the amount to 1 : 135 (in how long a time?).

I may add, as a matter of interest, although not directly relating to our present object, that the same standard solution of five per cent. by weight, when added to culture-fluids in the proportion of 1 : 250 (=1 :5,000 of SO_2 by weight), prevents the development of all the above-mentioned micrococci, while 1 : 500 (1 : 10,000 of SO_2) fails to prevent the development of the bacteria of putrefaction, or of the micrococcus from a vaccine vesicle, upon which organisms alone I have thus far tested the antiseptic power of this agent. These results also correspond closely with those of de la Croix, and show that sulphur dioxide ranks very high as an antiseptic.

In view of the experimental data recorded, it is evident that the use of sulphur dioxide for the disinfection of spore-containing material must be abandoned. This is the conclusion of Wolffhügel[1] on the basis of Koch's biological tests, and his own experiments. He is therefore inclined to abandon entirely the use of this agent for disinfecting purposes. He says, with reference to the question of its use for material not containing spores, that the answer to this question has very little interest from a practical point of view, as it is impossible to say in the present state of knowledge whether we have to deal with material free from spores or otherwise. Under the circumstances Wolffhügel thinks that we shall do well to abandon sulphur dioxide, and to use only such methods of disinfection as will be effective without reference to the presence or absence of spores.

I am not ready to go to this length, and to recommend the abandonment of an agent which enjoys the confidence of practical sanitarians for the destruction of the infection of small-pox, of scarlet fever, of diphtheria, of cholera, and of yellow fever, upon the ground that it fails to destroy the spores of the anthrax bacillus, or of *B. subtilis;* for the truth of the germ theory has not yet been definitely established for any one of the diseases named, and Wernitz has shown the power of this agent to neutralize non-living ferments. Admitting, however, as I do, the great probability that the infectious agent in these diseases is a living germ, we have good reason for believing that spores are not formed in any one of these diseases. We must not then be too exacting with reference to this agent until we are able to recommend something better in its place for the purposes to which it is commonly applied, viz., for the disinfection of apartments and ships.

My experiments show most conclusively that it does destroy the specific infecting power of vaccine virus dried upon ivory points when present in the air of a disinfecting chamber in the proportion one volume per cent., and that in aqueous solution it destroys the vitality of various micrococci in comparatively small amounts. It is even practicable to destroy these organisms dried upon pledgets of cotton by long

[1]Op. cit., vol. 1, p. 232.

exposure in gas-tight receptacles. But the conditions of success are such that it appears almost impracticable to conform with them in practice on a large scale, and it is evident that much of the so-called "disinfection" with this agent is a farce.

I am convinced that the percentage of SO_2 present in the disinfection chamber, above a certain limit, is of less moment than certain conditions relating to the material to be disinfected. Thus, Koch succeeded in destroying the vitality of anthrax bacilli, still moist from the spleen of a mouse, and attached to silk threads, by exposure for one hour to .48 volume per cent. of SO_2, in a disinfection chamber the atmosphere of which was loaded with moisture. In my own experiments with vaccine virus upon ivory points a still smaller amount (5 volumes per 1,000) was effective in four hours' time. Here the favorable conditions are without doubt the very thin stratum of material to be disinfected, and the fact that it is thoroughly moistened.

Admitting that, in the absence of spores, micro-organisms suspended in the atmosphere, or attached to the surface of objects, may be destroyed by sulphur dioxide when generated in a sufficient quantity in a well-closed apartment and in the presence of moisture, the question remains whether the same object may not be as well accomplished by thorough ventilation, and by washing all surfaces—walls, ceilings, floors, furniture, etc.—with a 1 : 1,000 solution of mercuric chloride, which we know to be promptly destructive of germs of all kinds.

EXPERIMENTS WITH SULPHUROUS ACID GAS.

BY J. H. RAYMOND.

The following experiment was made in Brooklyn, at the request of the commissioner of health, with the object of determining the germicide value of sulphurous acid gas, produced by the burning of sulphur in the manner recommended by boards of health generally. Dr. George M. Sternberg, U. S. A., kindly proffered his services, and conducted the inoculation with the material prepared by him at Johns Hopkins University. The methods employed were the same as he has employed in similar experiments, and which he has repeatedly described. Dr. W. E. Griffiths, of Brooklyn, and the reporter assisted in the experiment.

The room selected was on the second floor of a private residence, and connected with it was a small clothes-closet. Two doors opened out from it,—one into the hall, the other into an adjoining room. The experimental room had a single window. All cracks and crevices by which fumes could escape were carefully closed by cotton. In the room were the following articles: A carpet on the floor; a wooden bedstead with springs, on which were two mattresses in close contact; a chair, over which was spread a bed-quilt; a sofa; an empty stand of drawers, on the top of which was placed a large book; the closet was empty. The

room and closet together contained, as nearly as could be ascertained, 1,850 cubic feet of air space, and were in free communication.

On the 18th of April pieces of blanket, about four inches square, soaked with blood from a rabbit killed while affected with septicæmia, and other similar pieces soaked with blood from another rabbit affected with anthrax, were exposed in different parts of the room, as hereafter described. Some of these pieces were folded double, with the blood inside the fold; others were left unfolded.

Piece No. 1, soaked with septicæmic blood, unfolded, was placed on the floor of the closet.

No. 2, septicæmic blood, unfolded, was pinned to the upper part of the window frame, eight feet from the floor.

No. 3, septicæmic blood, folded, was attached to frame of closet door, seven feet from the floor.

No. 4, septicæmic blood, unfolded, was placed between the mattresses, which were in close contact.

No. 5, septicæmic blood, unfolded, pinned to the under side of the bed-quilt, which was spread over the chair.

No. 6, anthrax blood, unfolded, placed on the closet floor.

No. 7, anthrax blood, folded, attached to frame of closet door, seven feet from the floor.

No. 8, anthrax blood, unfolded, placed between the lower mattress and springs.

No. 9, anthrax blood, unfolded, attached to frame of the door leading into the adjoining room, six feet from the floor.

No. 10, anthrax blood, unfolded, placed between the mattresses.

No. 11, anthrax blood, unfolded, placed under the carpet, eight inches from the edge, the carpet again laid down, but not tacked.

No. 12, anthrax blood, unfolded, placed in the middle of the book, between the leaves, the book being closed.

No. 13 was a piece of blanket soaked with anthrax blood, which was not exposed in the room, but was prepared for purposes of comparison.

No. 14 was another piece soaked with septicæmic blood, and also not exposed.

Two half-quills of fresh bovine vaccine virus were placed on the stand of drawers, and one half-quill on the top of the frame of the door leading into the adjoining room. The corresponding halves, similarly marked, were placed in a tight preserve jar, which was at once put in a refrigerator in another part of the house.

In the middle of the room was placed a large coal scuttle nearly filled with wet ashes, and in this an iron pot holding four pounds of broken sulphur and two pounds of flowers of sulphur. This was then well moistened with alcohol, and a lighted match applied. When the sulphur was well burning the door of the room was closed, which was at 1:25 P. M. At 11:25 P. M. the hall door and window were opened for one hour, and the room thoroughly aired. At the end of this time the odor of sulphur was distinctly perceived, but there was no difficulty of

breathing in any part of the room. The sulphur in the pot was completely consumed. At the end of the hour the door and window were again closed, and kept so until 10 A. M. the following day, the 19th. When the door was again opened the air of the room was so impregnated with sulphur that respiration was impossible, and an airing of ten minutes was necessary before it could be entered.

At the end of this time the pieces of blanket were collected, and at 12 M. healthy rabbits were inoculated by Dr. Sternberg with the blood soaked out from the pieces of blanket in sterilized beef tea. The rabbits, so fast as inoculated, were put in a cage, each in a separate compartment, and given the same numbers as those of the pieces of blanket, with the blood of which they had been inoculated. The inoculation was complete within an hour.

The vaccine which had been exposed to the fumes was put into the jar containing the non-fumigated virus, and the jar replaced in the refrigerator, where it was kept until the material was used in vaccination.

RESULTS.

Rabbit No. 3, inoculated with septicæmic blood from folded piece, which had been fumigated, was found dead in the cage at 7 A. M., April 21st, forty-three hours after inoculation. He was apparently well the night before; the exact time of death is not known.

Rabbit No. 14, inoculated with non-fumigated septicæmic blood, died at 2 P. M., April 21st, fifty hours after inoculation.

Rabbit No. 7, inoculated with anthrax blood from folded piece which had been fumigated, was found dead at 7 A. M., April 23d, ninety-one hours after inoculation, being apparently well the night before.

April 20th a child, 7 months old, previously unvaccinated, was vaccinated by Dr. Griffiths in two places upon the same arm, one with virus from the fumigated half, and the other with virus from the non-fumigated half, of the same quill. The latter was successful; the former failed utterly.

The same was practised upon a young lady, 20 years of age, showing no vaccine cicatrix, and stating that she had never been vaccinated, with a fumigated and a non-fumigated half of a quill with the same result, namely, failure from the fumigated and success from the non-fumigated slip.

A calf was vaccinated in the same way, on the inner sides of the two thighs, with the same result.

Interpretation of Results. There seems to be no doubt that sulphurous acid gas, produced from burning sulphur, destroys the vitality of vaccine virus. This has been heretofore demonstrated by Dr. Sternberg, and this experiment confirms it.

It will be noticed that the rabbit inoculated with non-fumigated septicæmic blood, No. 14, died, as did also No. 3, the one inoculated from the folded piece of blanket; while all the other rabbits, inoculated with

septicæmic blood, were apparently unaffected, and survived—even No 4, which was inoculated with blood from the blanket placed between the two mattresses in close contact. I cannot understand how the gas could more readily have found its way between the mattress, and destroyed the germs there placed, than between the folds of a small piece of blanket hung up in the room.

As the rabbit inoculated with non-fumigated anthrax was apparently unaffected, while one inoculated with fumigated anthrax died, I think no conclusions of any value can be drawn from this part of the experiment.

Finally, after a careful review of the experiments and its results, I am led to regard the vaccine experiment as a success, and confirming what has already been well settled—the experiment with septicæmia as unsatisfactory, and the one with anthrax as a failure.

As a matter of precaution, the rabbits were kept for one month after inoculation, at the end of which time all were well, save the three already referred to.

NOTE.—The experiment with the septic virus seems to me to have been quite satisfactory and definite. The *temoin* died at the proper time, showing the potency of the virus. This potency was destroyed by the action of the sulphur dioxide in every case except in that in which the piece of blanket was folded, while the septic blood was still moist. This was the most difficult test, as the layer of dried blood to be penetrated was twice as thick as in the unfolded pieces of blanket, and it was necessary that the gas should penetrate an entire thickness of blanket saturated with dried blood, in order to reach the germs included in the material on the inside which cemented the folds of blanket together. The failure of the *temoin* in the anthrax experiment is a sufficient reason for excluding this part of the experiment. This failure was no doubt due to the fact that my anthrax stock is very much "attenuated" in virulence by having been cultivated in fluid media through many successive generations, and exposed often for weeks to the action of oxygen in the hermetically sealed flasks in which I keep my pure cultures. I have found that this same stock fails completely to kill white rats, but it commonly kills rabbits. Possibly the *temoin* in this experiment did not receive as large an amount of material as was injected into the rabbit, which died from the inoculation with anthrax blood taken from the folded blanket. The fact that this rabbit did die shows the virulence of the material, and it is extremely probable that this virulence was destroyed by the disinfectant in the unfolded pieces of blanket, although, as stated, this cannot be accepted as demonstrated, owing to the fact that the *temoin* did not die. G. M. STERNBERG.

EXPERIMENTS ON BURNING SULPHUR IN CLOSED ROOMS, UNDER DIRECTION OF J. H. RAYMOND.[1]

In these experiments the following points have been considered: The action of sulphur fumes on various ordinary insects and different kinds of cloth, the amount of sulphur which may be burned in a given volume of air, the volume of gases resulting, and the nature and extent of the decomposition of sulphurous acid in the presence of moisture after the combustion of the sulphur in the process of disinfection.

As being closely connected with these subjects, we also include in this report the following statement of the physical changes which sulphur

[1] By W. H. Kent, Ph. D., chemist to the the Brooklyn Health Department.

undergoes in the process of combustion. This we quote from Lunge's standard work on the "Manufacture of Sulphuric Acid:"

Sulphur melts at 111.5° C. (232.7° F.), and forms a thin light yellow liquid, which, on being more strongly heated, becomes darker and thicker; at 250° to 260° C. (480° to 500° F.), it is nearly black, and so viscid that it does not run out when the vessel is upset; at a still higher temperature it becomes thinner again, keeping its brown color; and at 440° C. (824° F.) it boils, forming a brownish red vapor; but it begins to volatilize before boiling.

This is by heating out of contact with the air. When heated in the air, the same changes take place until the temperature of combustion is reached, which, according to Lunge, is 260° C. (482° F.). It then takes fire and burns with a purplish blue flame, forming SO_2, and giving out 2,221 metrical units of heat.

In consulting the literature of the subject, we find a very important article on the "Value of Sulphurous Acid as a Disinfecting Agent," by Dr. G. Wolffhügel, which in this connection should be noticed. Dr. Wolffhügel[1] gives experimental work on the following questions:

1. How may the requisite amount of sulphurous acid be with safety produced by means of burning sulphur in closed rooms?

2. What method is best adapted to determine the amount of sulphurous acid in the air, and the amount of gas taken up by the disinfected articles?

3. To what extent does the sulphurous acid in the air deviate from the amount calculated from the sulphur burned? What are the causes of this deviation, and how is the loss to be limited?

4. Does the gas formed distribute itself uniformly through the room, and do the articles in the room take up a large amount of the gas formed?

5. Does the gas leave the disinfected articles uninjured, or are they depreciated in value by treatment with sulphur?

6. What concentration of the gas suffices for the purposes, and what arrangement of the experiment is necessary to guarantee the results of disinfection?

Following this article in the same publication (pp. 234–282) is also one by Dr. R. Koch, in which, in connection with other disinfectants, he considers the amount of sulphurous acid, and time necessary to kill certain microscopic organisms.

With this mere notice of the nature of these papers, we pass to a description of our own experiments.

For a confined space in which to burn the sulphur, a room entirely enclosed by wood was at first used. The pine boards forming the walls, ceiling, and floor were generally matched, but in spite of continued calking with rags, its condition, as to tightness, remained unsatisfactory; however, three experiments with burning sulphur were performed, and a part of the desired results obtained. It was then abandoned, with the idea that the results, with regard to the amount of sulphur which it is possible to burn in a given space, would be of no value. We will call

[1] *Mittheilungen aus dem Kaiserlichen Gesundheitsamte*, vol. 1, pp. 188–233. Berlin, 1883.

this room *Room A*, and the small bed-room, with plastered walls, which was afterwards used, *Room B*. Room A was sixteen and one half feet long, eight and one third feet wide, and eleven feet high, and contained therefore 1,512.5 cubic feet (42,831.8 litres or 42.8318 cubic metres). In one side was a window about two by two and one half feet; in the adjacent side nearer the floor was also a single pane of glass about eight by ten inches.

Experiment No. 1, Room A.—In a large tin pan holding about twelve quarts (ordinarily known as a dish-pan) was placed an iron kettle holding five and one half quarts, and supported in the pan by an earthen plate; in the kettle were placed six pounds of broken brimstone and flowers of sulphur, and surrounding it, in the pan, were 8 litres (about 8 quarts) of water. The kettle stood in the water therefore to the extent of about half its height. In the water was placed a maximum and minimum thermometer. Before the larger window was suspended in the room one wire fly-trap with about a dozen flies, another with six or eight ants, and another with half a dozen croton bugs *(Ectobia Germanica)*. The fly-traps used in these experiments were made of tinned wire,—those painted with Paris green being in all cases avoided. There was also a thermometer so hung inside the room by the window as to show the temperature of the room from outside. Suspended on a line in about the centre of the room were one hundred and sixteen samples of various kinds of cloth, the coloring matters of which had been determined by Dr. O. Grothe. The samples consisted of,—

Eighteen samples of all wool dress goods (Sicilian cord) dyed with various combinations of logwood black, logwood brown, picric acid, indigo carmine, and Bordeaux.

Eight samples of silk dress goods (silk cord), which were also variously dyed with Bismarck brown, nigrosine, alkali blue 2 B, Bordeaux, tropæline 3 O No. 2, and roacelline.

Eleven samples of domestic calicoes printed in many figures with catechu brown, logwood black, logwood blue, alizarine red, aniline yellow, and aniline blue.

Twelve samples of French satins also printed with aniline black, aniline yellow, alizarine red, indigo, logwood black, fiset wood, eosine, nigrosine, Bordeaux, and alkali blue.

Twenty-four samples of Scotch gingham colored with different combinations of Bismarck brown, logwood black, logwood blue, logwood brown, indigo, aniline blue, aniline yellow, alizarine red, alizarine rosa (tin salts), catechu brown, tropæline O (chrysoine), turmeric, tropæline O 4, fiset wood, and vesuvine.

Twenty-four samples of domestic cambrics variously printed with aniline blue, aniline yellow, logwood black, logwood blue, logwood brown, alizarine red, catechu brown, indigo, indigo carmine, naphthaline yellow, induline, and wood blue with chromine.

Three samples of oriental flannels dyed with induline, malachite green, and Bordeaux.

Sixteen samples domestic flannels dyed with Bordeaux, Victoria yellow, fuchsine, methyl violet, logwood black, alizarine red, induline, and brilliant blue (alkali blue 5 B). Duplicate samples of each of these were retained for comparison afterward. Those exposed to the sulphur fumes were numbered the same as the original, and with the additional mark of the letter *x*.

The sulphur was ignited with burning alcohol, and the room closed as soon as possible.

The time necessary for killing the insects, as observed from the window outside, was as follows:

All flies were dead in 22 minutes; all ants were dead in 24 minutes; all croton bugs were dead in 25 minutes.

The temperature of the room as noted each half hour was as follows:

10:35 A. M.,	73° F.	—at beginning.
11:05 "	85° "	The room became cloudy with smoke so that the burning sulphur could not at all times be seen.
11:35 "	91° "	
12:05 P. M.	94° "	
12:35 "	96° "	
1:05 "	97° "	
1:35 "	95° "	—Saw the flame for the last time.
2:05 "	93° "	
2:35 "	90° "	
3:05 "	89° "	
3:35 "	89° "	
4:05 "	88° "	
4:35 "	88° "	
5:05 "	87° "	
5:35 "	86° "	
6:20 "	85° "	

At 8:30 P. M. the room was opened.

Of the 6 lbs. of sulphur introduced, 5 lbs. and 9 oz. were burned; the remaining 7 oz. consisted of sulphur, sulphide of iron, and impurities. Owing to the reduction of temperature, it would not in any case be expected that the sulphur would be completely consumed.

Of the 8 litres of water introduced in the pan, 6.39 litres remained; 1.61 litre was, therefore, evaporated. The temperature of the water, which at the beginning was 71° F., had risen to 158° F.

The samples of cloth were then arranged in series by the side of the original, and exhibited to a number of persons, some of whom were experienced dry goods salesmen, and were really experts in judging the qualities of fabrics. The general opinion was that as to strength of fibre, no change in any case could be discerned; that as to color, one sample of Sicilian cord, colored with indigo and induline, and one sample of domestic flannel, colored with brilliant blue (alkali blue 5 B), were very slightly faded; that one sample of oriental flannel, colored with malachite green, was not quite so bright; that one sample of oriental flannel and one sample of domestic flannel, each colored with induline, were somewhat faded; that with the remaining one hundred and eleven samples there was no perceptible change. It is also observed that among the flannels

only two were colored with induline, and that these, as above expressed, were the most affected, and that the only piece of woollen dress goods which contained induline was the one which was very slightly faded.

Experiment No. 2, Room A.—In this experiment an attempt was made to reach the limit of sulphur which might be burned in the room. Thirty-two lbs. 5 oz. of sulphur were placed in two kettles;—one kettle, with 16 lbs. 4 oz. placed in the tin pan as before, was surrounded with 8 litres of water; the other, with 16 lbs. 1 oz., was placed in a wooden tub, and around it were 25 litres of water. In each case fully one half of the kettle stood below the surface of the water. There was also suspended in the room, the same as before, a set of samples of the same fabrics from which those before used were taken, numbered the same, and for distinction marked with the letter Y. The thermometer was also hung before the window, the sulphur ignited with alcohol, and the room closed as before. The temperature was as follows:

1:00 P. M.,	122° F.	
1:30 "	124° "	
2:00 "	124° "	
2:30 "	126° "	
3:00 "	129° "	
3:30 "	131° "	
4:00 "	131° "	—Maximum = 55° C.
4:30 "	130° "	
5:00 "	128° "	
5:30 "	121° "	
6:00 "	115° "	
6:30 "	109° "	

At 9 P. M. the sulphur ceased burning.

On the following day the room was opened. The sulphur fumes had escaped so that it could be entered immediately. Of the 16 lbs. 4 oz. sulphur placed in one kettle, 6 oz. remained, and of the 16 lbs. 1 oz. placed in the other, 9 oz. remained, or of the 32 lbs. 5 oz., 31 lbs. 6 oz. were burned; the remaining 15 oz. consisted of sulphide of iron, sulphur, and impurities.

Since the room contained about 1,500 cubic feet, the amount burned was nearly 21 lbs. per 1,000 feet.

The water surrounding the kettle was found to contain much sulphuric acid. From the following calculation it is concluded that the amount burned was largely in excess of what was necessary to consume the oxygen of the air, and as the sulphur was practically all consumed, the room must be considered as not sufficiently tight for the experiment.

The Amount of Sulphur Necessary to Completely Consume the Oxygen in 1,000 Cubic Feet of Air.—Since the atomic weight of S is 32, and that of O is 16 (one half that of S), and since by burning sulphur SO_2 is formed, a compound with one atom of S and two of O, the weight of sulphur in SO_2 is just equal to the weight of oxygen; so the amount of sulphur necessary to completely burn the oxygen of the air is equal to the weight of the oxygen in the air.

One litre of air at O°C weighs 14.43 criths (Cooke), or as one crith=.0896 gramme, one litre of air weighs 1.2929 gramme. At 55°C., the temperature to which the air was heated by the burning sulphur, one litre$=\frac{1.2929}{1+0.00366 \times 55}=$1.0762 gramme. One cubic foot=28.318 litres. or 1,000 cubic feet=28,318 litres. In 1,000 cubic feet there are therefore 30,475.8 grammes, or 67.186 pounds of air. As 23.185 per cent. of the air is oxygen, the amount of oxygen in 1,000 cubic feet is 67.186×23.185=15.577 lbs.; or, in accordance with the above, 1,000 cubic feet of air would need for the complete burning of the oxygen 15.577 lbs. of sulphur. Of course the low temperature and the highly diluted form the oxygen attains would both tend in practice greatly to reduce this amount.

Vallin[1] states that, experimentally, M. Marty was able to burn only 68 grammes per cubic metre, or about 4.2 lbs. per 1,000 cubic feet, and that Czernicki was able to burn in a large room 300 grammes per cubic metre, or 18.7 lbs. per 1,000 cubic feet. The room in the latter case was undoubtedly not tightly closed, as a comparison of his results with the theoretical amount will show. As to the effects on the fabrics in this experiment, no difference could be noticed from that of the experiment before given. The samples of cloth in both experiments are arranged in convenient form with those of the original, and may be examined at the office of the Department of Health in Brooklyn.

Experiment No. 3, Room A.—It having been asserted that burning sulphur is not always effective in killing insects, and especially flies on the ceiling, another experiment was made to ascertain with more certainty whether flies are killed uniformly throughout the room where the usual amount of 3 lbs. of sulphur per 1,000 cubic feet is burned. To this end a window was placed next the ceiling by the upper front left corner of the room, and another by the diagonal corner of the left side next the floor. A fly-trap with a number of flies was placed by each window next the ceiling and floor. Flies in traps were also placed at the upper back right corner and on the floor by the diagonal corner of the right side; one was also placed on the centre of the floor, and another on the centre of the ceiling, and one by the window in the centre of the left side. There were also a number of flies, perhaps fifty, confined loose in the room, going where they chose. An iron kettle, with 4 lbs. and 9 oz. of sulphur, was placed in water in the large pan, the sulphur ignited, and the room closed as before. The flies next the ceiling, as observed from the window at the upper front left hand corner, were all dead in twenty-three minutes; those by the large window on the left side also in twenty-three minutes; those on the floor at the back left hand corner were dead in fifty minutes; while some of the flies loose in the room, that had collected mostly by the small window in front, near the floor, lived for one hour and forty-five minutes.

The sulphur fumes, being heated, evidently rose at first to the upper part of the room. The room was then immediately opened, the sulphur

[1] "Traité des Désinfectants," p. 243.

extinguished, and as soon as the room could be entered it was found that in all portions of the room which could not be seen from the windows all flies were dead. It would seem, therefore, that when the flies are simply confined in a room not especially tight, they were able by the greater liberty afforded them to withstand the action of the sulphur fumes much longer than when confined to a particular locality in traps. By weighing the kettle and the remaining sulphur, it was found that four pounds of sulphur were burned.

Experiment No. 4, Room B.—This room, provided with an ordinary window and door, measured as follows: 8 ft. 2 in. long, 6 ft. 2 in. wide, and 7 ft. 7 in. high, containing, therefore, 375 cubic feet. All crevices were thoroughly calked. In an iron pot was placed 16 lbs. 3 oz. sulphur. This was placed in the above described tin pan, and surrounded by nearly 10 litres of water. A maximum and minimum thermometer was hung on the wall, showing a temperature at the beginning of 76° F. In order to ascertain whether sulphuric acid would be formed, and whether the cloud of smoke arising from burning sulphur was due to the formation of this acid, or to sublimed sulphur, or both, a pane of glass 7 by 12 inches was thoroughly cleaned, wiped dry with a clean cloth, and supported horizontally in the middle of the room by a clean glass support. The sulphur was ignited, the door thoroughly calked, and, it being Saturday P. M., it was left to take its course. The sulphur continued to burn for about twelve hours. When opened on Monday the atmosphere was not endurable. The temperature of the room had risen to 122° F. (50° C.), as shown by the maximum thermometer. Of the 16 lbs. 3 oz. sulphur introduced, 2 lbs. 2 oz. had been burned, or at the rate of 5⅔ lbs. per 1,000 cubic feet. The pane of glass was found to be covered with a fine, dew-like deposit, and its extremely sour taste indicated that it must contain sulphuric acid. This was carefully washed with distilled water into a clean flask. The washings unmistakably held sulphur in suspension. The amount of sulphur deposited on the pane of glass was determined after filtering from the H_2SO_4 solution by oxidizing with nitric acid, precipitating and weighing as $BaSO_4$. From this the amount of sulphur deposited on the glass plate was found to be .0014 gramme. Since the surface of both sides of the glass pane was 168 square inches, and the surface of the ceiling and floor 14,504 square inches, the amount of sulphur deposited on the ceiling and floor would be .1208 gramme. Assuming that it would be deposited on the walls at the same rate, which may not be entirely the case, there would be deposited on the walls, ceiling, and floor .3817 gramme, or 5.88 grains of sulphur. This amount, though not large, is sufficient to account for the slightly dingy appearance of a room immediately after fumigation, and in part also for the cloud of smoke that arises from the burning sulphur. The sulphuric acid in the filtrate, as above obtained, was precipitated as $BaSO_4$ after the addition of HCl and the $BaSO_4$ filtered and weighed. The H_2SO_4 calculated therefrom was .0848 gramme. The amount deposited on ceiling and floor, as calculated from this amount

deposited on the pane of glass, is 7.3210 grammes, and assuming as above that it would be deposited at the same rate on the walls of the room, there would have been formed 15.2 grammes, or about 234 grains of sulphuric acid.

Experiment No. 5, Room B.—It being sometimes the practice to place the pot of sulphur on dry ashes instead of in water, the question now arises as to whether by so doing there is the same amount of sulphur burned, and also whether the same amount and relative proportion of sulphuric acid and sulphur are set free, as found in the preceding experiment. In order to ascertain these points the following experiment was arranged:

The large tin pan heretofore used was nearly filled with ashes, and placed near the middle of the room. On the ashes was placed an iron kettle with 8 lbs. of sulphur. An ordinary pane of glass, 9 by 12 inches, was thoroughly cleaned, and horizontally supported about 1½ foot from the floor with a clean glass support. On the wall was also a maximum and minimum thermometer showing a temperature at the beginning of the experiment of 80° F. The sulphur was ignited with burning alcohol, and the room thoroughly closed. On opening the room the following day all smoke had subsided, but sulphur fumes were so strong that it could not be immediately entered. By weighing the pot of remaining sulphur it was found that 2 lbs. 7 oz. had been consumed, or at the rate of 6½ lbs. per 1,000 cubic feet, which, as will be noticed, is ⅝ lb. per 1,000 cubic feet more than was burned when the kettle was placed in water. Of course this is due to the fact that the water takes some heat from the kettle and its contents, and thereby reduces its temperature. The thermometer on the wall showed a minimum temperature of 73° F., and a maximum temperature of 113° F. On the glass plate was the same dew-like deposit as before, but showing the presence of sulphur much more distinctly. The deposit was carefully removed with distilled water to a glass receptacle, the sulphur filtered therefrom, oxidized with nitric acid, and precipitated with barium chloride. By weighing the precipitate of $BaSO_4$ and calculating the sulphur, it was found that .0228 gramme of sulphur had been deposited on the glass plate. Calculating from this, the amount deposited on the ceiling and floor would be 1.5310 gramme. If deposited on the walls at the same rate the entire amount formed in the room would be 4.8352 grammes (74.5 grains). The sulphuric acid in the filtrate from the sulphur thus obtained was precipitated and weighed as $BaSO_4$, from which it was ascertained that .1209 gramme H_2SO_4 had been deposited on the plate, or 8.1145 grammes on the ceiling and floor. Calculating as before, the total amount deposited in the room would be 25.6397 grammes, or 394.85 grains.

The presence of sulphur and sulphuric acid as found in these experiments is in accordance with the statements of Vallin (pp. 243 and 245). He terms the sulphur thus formed, however, sublimed sulphur, or sulphur vaporized from the original mass, and escaping the flame without being burned. From the following it will hardly appear that it is sub-

limed sulphur. According to Richter sulphurous acid in aqueous solution gradually undergoes the following reaction,—$3SO_2+2H_2O=2H_2SO_4+S$, —from which we would see that sulphur and sulphuric acid are formed by the action of sulphurous acid on water, and in the proportion of 196 parts of sulphuric acid to 32 parts of sulphur. The conditions in the case of burning sulphur for disinfecting purposes differ from these only in this, that the sulphurous acid and water are in the gaseous form. The relation of the amount of sulphuric acid and sulphur deposited on the glass plates in these experiments may be taken as approximately expressing the relation of the total amounts formed, and this relation is sufficiently near that of 196 to 32 to make it probable that it is formed, mostly at least, from the decomposition of sulphurous acid.

Another point of chemical interest, and which may have some practical bearing in this connection, is the fact that much more sulphur and sulphuric acid are formed when ashes are used than when the receptacle for the burning sulphur stands in water. In all those cases where the burning sulphur was surrounded by water, it has been observed that a considerable amount of water is evaporated. The atmosphere of the room must therefore be charged with moisture.

It is known in the ordinary method of making sulphuric acid that an excess of water or steam interferes with the oxidation of the sulphurous acid; and, although the conditions are not the same in the two cases, the results above obtained show a resemblance in this respect.

As to the amount of water present when ashes are used, we know there is always a small amount of moisture in ordinary air, and that when alcohol is used to ignite the sulphur as in these cases, some water is formed by the combustion of alcohol; so it is apparent that there is a considerable amount of water present to carry out the decomposition of the sulphurous acid. A fact of ordinary observation in a chemical laboratory is that a solution of sulphurous acid in water only very gradually undergoes decomposition, and that even in the presence of strong light some weeks may be necessary to make much change. This would corroborate the conclusion we would draw, that an excess of water interferes with the decomposition of sulphurous acid; that if the presence of sulphuric acid is necessary to kill the organisms, the amount may be increased by avoiding the presence of too much water; and that if the formation of sulphuric acid is to be avoided, placing the receptacle for the sulphur in water is very effective to that end.

The Effect of Burning Sulphur on the Volume of Air Confined.— By burning sulphur in hermetically closed places, the question as to whether the volume will become changed so as to cause an injury to the walls, or possibly an explosion, is considered as follows:

Since by the consumption of the O_2 of the air SO_2 is formed, and since to form one molecule of SO_2 one molecule of O_2 is necessary, we have formed according to the equation, $S_2+2O_2=2SO_2$, as many molecules of SO_2 as is consumed of O_2, and so, according to Avogadro's law, the volume of SO_2 formed is equal to the volume of O_2 consumed, or, in

other words, there is no increase or decrease in the volume of the air except that which comes as expansion by heat.

It being very seldom that perfectly tight compartments are found, and as gases in general are so very elastic, the amount of pressure exerted on the walls by such expansion would in most cases be insufficient to do any damage.

SULPHITES.

BY GEORGE M. STERNBERG.

Sodium Sulphite and Sodium Hyposulphite.—My experiments made at San Francisco[1] show that these salts in concentrated solution have no germicide power. The micrococcus of pus was not killed by exposure for two hours to a 32 per cent. solution, and a saturated solution failed to destroy the bacteria in broken-down beef tea. Arloing, Cornevin, and Thomas found that exposure for forty-eight hours to a 50 per cent. solution of sodium hyposulphite does not destroy the virus of symptomatic anthrax. It is evident, from the experimental evidence on record, that these salts have no value, either as germicides or as antiseptics, *except in the presence of some chemical agent which will liberate the sulphurous acid.*

Bisulphite of Lime, *Bisulphite of Zinc*, *Bisulphite of Soda*, *Tersulphite of Aluminium.*—A manufacturing chemist of New York sent me, last spring, samples of the above mentioned salts in solution, and I made a number of tests to determine their comparative germicide power. The results obtained indicate that their value as disinfectants depends upon the amount of sulphurous acid which they contain. All of the solutions gave off sulphurous acid gas constantly when not kept in tightly corked bottles; and, in adding them to broken-down beef stock, an abundant liberation of this gas occurred.

The solution of bisulphite of lime gave the best results. In the proportion of 5 per cent. this destroyed the vitality of *M. tetragenus*, the test organism employed. The solution of bisulphite of zinc and tersulphite of aluminium failed to destroy the same micrococcus in the proportion of 5 per cent., but were successful in 10 per cent. The solution of bisulphite of soda failed upon the same organism in 10 per cent. I have lost my memorandum giving the specific gravity of these solutions, but believe them to have been saturated solutions of the salts named.

DRY HEAT.

BY GEORGE H. ROHÉ.

The first accurate observations on the disinfecting power of dry heat were made by Henry, of Manchester, in 1831.[2] Henry exposed (fresh?)

[1]"American Journal of the Medical Sciences," April, 1883.
[2]E. Vallin: "Traite des Désinfectants," Paris, 1882, p. 226.

vaccine virus to temperatures varying from 50° to 82° Cent. (122°–180° Fahr.) for two, three, and four hours, and secured complete disinfection, none of the specimens of vaccine thus exposed producing vaccinia when subsequently inoculated. Exposure for three hours to a temperature of 49° C. (120° F.) failed to disinfect. No control experiments with non-disinfected virus were made by this observer.

E. B. Baxter[1] exposed dry vaccine to a temperature of from 90°–95° C. (194°–203° F.) for thirty minutes. Disinfection was complete. Vaccination with disinfected virus was unsuccessful. Control inoculations with non-disinfected virus were successful.

Carstens and Coert reported to the International Hygienic Congress of 1879 (quoted by Vallin in the above-mentioned work) the following conclusions:

> Fresh animal vaccine heated to 64.5° C. (148° F.) for thirty minutes loses its virulence. Fresh animal vaccine heated to 52° C. (125° F.) for thirty minutes does not lose its virulence. The maximum degree of heat to which fresh vaccine can be exposed without losing its infectivity probably varies between 52° and 54° C. (125°–129° F.).

Davaine, in 1873, destroyed the virulence of fresh anthrax blood[2] by exposing it to temperatures of 55° C. (131° F.) for five minutes, 50° C. (122° F.) for ten minutes, and 48° C. (118° F.) for fifteen minutes.

Werner, in 1879, exposed putrefactive bacteria on pledgets of cotton, and then enveloped in dry cotton to a temperature of 125° C. (257° F.) for one hour, and secured complete disinfection.

Wernich[3] exposed putrid material (containing bacteria of putrefaction) to temperatures of from 125°–150° C. (257°–302° F.) for five minutes with like success.

Schill and Fischer[4] found that exposure for one hour to a temperature of from 100°–130° C. (212°–266° F.) destroyed the virulence of tuberculous sputum, as tested by the inoculation of rabbits and other animals.

Koch and Wolffhügel[5] experimented with a large number of pathogenic and non-pathogenic organisms. A temperature varying from 78°–123° C. (172°–253° F.) maintained for one hour and a half (over 212° F. for an hour) sufficed to kill micrococcus prodigiosus and the bacilli of septicæmia of mice and rabbits, but failed to destroy the spores of bacillus anthracis, and of various non-pathogenic bacteria and fungi.

Micrococci and bacilli containing no spores, and spores of mould fungi, were completely killed by one and a half hour's exposure to a temperature of from 120°–128° C. (248°–262° F.); but spores of *B. subtilis*, *B. anthracis*, and of a bacillus growing upon potato, resisted a second heating to the same temperature for a similar length of time.

These authors further experimented upon a number of organisms disposed in various ways in the disinfecting chamber so as to approach in

[1] "Report Medical Officer of Privy Council," etc., N. S., No. vi, p. 216.

[2] Containing bacilli, but no spores.

[3] "Deutsche Med. Wochenschr.," 1880, p. 498.

[4] Mitt. a. d. Kais. Gesundheitsamte, Bd. II, S. 134.

[5] Mitt. a. d. Kais. Gesundheitsamte, Bd. I.

a measure the conditions of practical disinfection. Some of the articles were placed in coat pockets, others rolled up in balls of cotton, oakum, blankets, or soiled clothing, making packages of different thickness and density. The organisms consisted of micrococcus prodigiosus, micrococcus of blue pus, *B. anthracis*, and bacilli found in garden soil. With each package was placed a registering thermometer to indicate the highest temperature reached during the experiment. The temperature in the chamber varied from 133° to 156° C. (271°–313° F.), and the exposure was continued for three hours and ten minutes. The temperature in the different packages varied from 74.5° C. (167° F.) to 121.5° C. (251° F.). In none of the packages were the spore-bearing organisms destroyed. In a small iron vessel hanging free in the chamber, and containing specimens of the same organisms, a temperature of 139.5° C. (283° F.) was indicated by the thermometer. Here complete disinfection had taken place.

Another series of observations, with the temperature in the chamber varying from 131°–140° C. (267°–284° F.), and exposure continuing for three hours, resulted as follows: The organisms (micrococcus prodigiosus, spores of *B. anthracis*, and of bacilli of garden soil) and registering thermometers were enclosed in packages of clothing, bedding, and rolls of blankets. Complete destruction of the spore-bearing organisms did not follow unless the temperature of 139° C. (282° F.) had been reached. In one large package consisting of nineteen blankets, thoroughly dried and rolled up, the heat did not penetrate to the interior in a sufficiently high degree to destroy the vitality of micrococcus prodigiosus even.

These experiments were still further varied, but the results did not differ materially from those already given. They all showed the great difficulty of penetration of thick packages of fabrics of various kinds by a sufficiently high temperature to produce disinfection.

A large number of fabrics (linen, silk, cotton, wool, feathers, paper, and leather) were exposed for five hours to a temperature of from 150°–160° C. (302°–320° F.) with the result of producing such changes in color and texture of most of them as to render them useless.

In a similar series of experiments, Ransom[1] found that exposure to a temperature of from 240°–250° F. would be borne by clothing materials without injury. Vallin[2] states that cotton and wool fabrics do not change color at a lower temperature than 125° C. (253° F.), which corresponds closely with the observations of Ransom.

Koch and Wolffhügel[3] submit the following conclusions, which seem to the writer to be fully justified by the results of their own and other observations here collected:

1. A temperature of 100° C. (212° F., dry heat), maintained for one hour and a half, will destroy bacteria which do not contain spores.

[1] *Practitioner*, 1878, p. 67.

[2] Op. cit.

[3] Op. cit., p. 231.

2. Spores of mould-fungi require for their destruction in hot air a temperature of from 110°–115° C. (230°–239° F.) maintained for one hour and a half.

3. Bacillus spores require for their destruction in hot air a temperature of 140° C. (284° F.) maintained for three hours.

4. In dry air the heat penetrates objects so slowly that small packages, such as a pillow or small bundle of clothing, are not disinfected after an exposure of from three to four hours to a temperature of 140° C. (284° F.).

5. Exposure to a temperature of 140° C. (284° F.) in dry air for a period of three hours injures most objects requiring disinfection (clothing, bedding, etc.) to a greater or less degree.

MOIST HEAT.

BY GEORGE M. STERNBERG.

Whenever infectious material can be consumed by fire, there can be no question as to the efficiency of this mode of disposing of it. But from the experimental data given in the preceding paper, it will be seen that the destruction of desiccated spores by dry heat requires a temperature which injures textile fabrics.

It is quite different with moist heat, and in steam, at a temperature of from 105° to 110° C. (221° to 230° F.), we have an agent which quickly destroys all living organisms, including the most refractory spores.

In the absence of spores, all known micro-organisms are quickly destroyed when immersed in boiling water. Indeed, a temperature much below the boiling-point destroys micrococci and bacilli in active growth. Thus I have fixed the thermal death-point of the micrococcus of septicæmia in the rabbit, and of the micrococcus of pus (from an acute abscess), at 140° F. (60° C.), the time of exposure being ten minutes. This temperature is also fatal to the micrococcus of swine plague. The micrococcus of fowl cholera is destroyed by exposure for fifteen minutes to a temperature of 132° F. (Salmon). Nine or ten minutes' exposure to a temperature of 54° C. (129.2° F.) is sufficient to destroy the vitality of anthrax bacilli in blood (Chauveau). Davaine has shown, that, owing to the low thermal death-point of this bacillus, it may be destroyed in an inoculation wound by application of heated metal to the surface—hammer of Mayor. May it not be that the *rationale* of the effect of poultices applied "as hot as can be borne" to furuncles, acute abscesses, etc., is to be explained in the same way? Or, at least, if a temperature sufficient to destroy the vitality of micrococci which have invaded the tissues cannot be borne, is it not probable that their multiplication may be prevented by the continued application of a bearable temperature?

The resisting power of spores is very much greater, and it is well known that the spores of *B. subtilis* and of other species of the genus *Bacillus* withstand a boiling temperature for a considerable time. My culture-fluids have frequently "broken down," on account of the presence of the spores of *B. subtilis* after two hours' boiling, and to insure sterilization I am in the habit of resorting to a second boiling after an interval

of twelve hours, or of sterilizing in a bath containing some salt, by which a higher temperature than that of boiling water can be secured.

A temperature of five degrees Centigrade (9° F.) above the boiling point quickly destroys the most refractory spores. I have recently made numerous experiments upon the spores of *B. anthracis* and *B. subtilis*, which show that the former has less resisting power than the latter, but that both are destroyed with a temperature of 105° C. maintained for ten minutes. The same temperature failed to destroy the developing power of the spores of *B. subtilis* in five minutes, while two minutes' exposure destroyed the vitality of anthrax spores.

These results are in accord with those of Koch, Gaffky, and Loeffler,[1] who found, as the result of numerous experiments, that when a temperature of 105° and upward was maintained for ten minutes, all spores were destroyed, as shown by their failure to develop in culture-solutions. Where a temperature of 110° C. was reached, the experiment could be stopped, as no spores were capable of germinating after exposure to this temperature. Exposure to a temperature of 100° to 105° C. for twenty or thirty minutes was fatal to anthrax spores, but those of a certain short and thick bacillus found in garden soil were only killed when the temperature was maintained at 105° for twenty minutes.

The question as to the practicability of destroying spores in the interior of packages,—rolls of blankets, etc.,—has received the attention of the experimenters last mentioned, and will doubtless be considered by my colleagues of the Committee on Disinfectants, whose province it is to take account of the various points which may arise relating to the practical use of approved disinfecting agents.

From the experimental evidence presented, it is safe to say that the temperature of boiling water will quickly destroy the vitality of all micro-organisms of the class to which known disease germs belong, in the absence of spores.

Steam at a temperature of 110° C. (230° F.) maintained for one or two minutes, or of 105° C. (221° F.) maintained for ten minutes, will infallibly destroy the spores of bacilli, which constitute the most difficult test of disinfecting power known.

NOTE.—I desire to call attention to the close correspondence between the thermal death-point of micrococci as fixed by my experiments, viz., 140° F. for ten minutes, and the results obtained by the authors quoted by Dr. Rohé in the preceding paper, in the disinfection—*i. e.*, destruction of specific infecting power—of fresh vaccine virus by similar low temperatures. Certainly this correspondence gives some support to the supposition that infective virulence is due to the presence of the micrococcus found in vaccine lymph, although the etiological role of this micrococcus has never been demonstrated by successful inoculations with pure cultures.

[1] "Mitt. a. d. Kaiserlichen Gesundheitsamte," vol. 1, pp. 322-340.

ON THE DISINFECTANT PROPERTIES OF PUTREFACTIVE PRODUCTS.

BY CHARLES SMART.

It is well known that when a saccharine liquid undergoing fermentation has attained a certain alcoholic strength, the further growth of the yeast plant is prevented by the action of its alcoholic product. It is, perhaps, equally well known, that an inhibition of the acetous fermentation takes place when the liquid has reached a certain percentage of acetic acidity. But it is not so generally known that the bacteria of putrefaction elaborate, as products of their vital action, organic substances that are destructive to the organisms which determined their formation. The ultimate products in the retrogression of albuminous matters by bacterial or putrefactive agency are ammonia and carbonic acid; but a vast number of complex organic substances, concerning which our knowledge is meagre, constitute intermediate steps in the process. One of these, phenol, or carbolic acid, was at the time of its discovery as a product of putrefaction already well known as an antiseptic and probable disinfectant. Recently E. and H. Salkowski separated from these intermediate products two aromatic acids of the acetic series, hydrocinnamic or phenyl-propionic and phenyl-acetic acid.

Wernich[1] submitted these to experiment, and found that as antiseptics they were superior to carbolic acid, the phenyl-propionic acid being the more active of the two. Klein[2] followed up these researches by an inquiry into their germicidal value. Some of his experiments bear with greater interest on the life history of the organisms subjected to the influence of the acids than on the germicidal value of the latter; but, to complete this series of papers, it has been deemed advisable to submit a summary of his results.

This able experimenter recognized the difference between antisepsis and disinfection that has been insisted upon in the reports of this committee. He exposed the organisms that were the subject of the experiment to the action of the acids, and then introduced them into a suitable culture-medium; or, if they were of a pathogenic nature, inoculated animals with them,—a failure to cultivate, or a failure to reproduce the disease being respectively in each case the test of a germicidal or truly disinfectant action.

The non-specific organisms subjected to experiment were a small micrococcus derived from the blood of rabbits, a large micrococcus of similar derivation, bacterium termo and *Bacillus subtilis*. An exposure of twenty or twenty-five minutes in a solution of either acid of the strength 1 : 200, failed to destroy the vitality of any of these specimens; the last mentioned, indeed, was not destroyed by an exposure of twenty-four hours.

The pathogenic matters treated were the spores and bacilli of anthrax, the virus of swine-plague, and that of tuberculosis.

[1] "Virchow's Archiv," vol. 78, p. 51.

[2] "Supplement to Thirteenth Annual Report of Local Government Board," London, 1884, p. 111.

Anthrax *spores*, exposed for two or more days in either acid of the strength 1 : 400, were found to have retained their virulence when subsequently injected into guinea-pigs, and to be susceptible of cultivation in culture-liquids, with the retention of virulence in their progeny. But, although the spores withstood the influence of the acids, the bacilli of anthrax were killed immediately, or as soon as they were thoroughly mixed with this strength of either of the acids. The phenyl-propionic acid, however, was manifestly more efficient, for a dilution of 1 : 800 destroyed the bacilli in ten minutes, while the phenyl-acetic acid under similar conditions failed to accomplish disinfection. Greater dilutions required a longer period to effect the destruction of the bacilli, and in all instances the phenyl-propionic acid showed the greater potency. Thus, while this acid, in the strength 1 : 3,200, required from twenty-five to thirty-five minutes to be effective, the phenyl-acetic acid of the same strength required fully thirty-five minutes.

Several other points of interest were developed. It was noted that in greater dilutions than 1 : 400 of either acid, a stronger solution or a longer exposure was required to kill bacilli grown from a previous culture containing spores than those from a culture started from blood bacilli. It was observed further that bacilli cultivated from bacilli of the blood have a greater resistance than the latter, so far as these acids are concerned, for the first week or ten days of the cultivation, but that after this their power of resistance decreases, so that ultimately it becomes even less than that of the original blood bacillus. The fact was also shown that bacilli in the blood of a guinea-pig dead from inoculation with spores have a greater resistance to the influence of the acid than those from an animal dead from inoculation with bacilli.

The virulence of swine-plague, taken directly from an animal dead of the disease, and also that of the artificially cultivated microbe, were destroyed by an exposure of twenty or twenty-five minutes to a phenyl-propionic solution of the strength 1 : 800; weaker solutions were not efficient, and the disinfectant action of the phenyl-acetic acid of this strength was not certain.

The tubercular virus, like the spores of anthrax, resisted the influence of these acids. An exposure of ninety-six hours to a strength 1 : 200 did not prevent the caseous matter of pulmonary tuberculosis from producing its characteristic effects when injected into a guinea-pig. But considerably stronger solutions showed the exercise of an inhibitory power. Bovine virus manifested a greater resistance against the influence of the acids than the tuberculous virus of man.

PRACTICAL EXPERIMENTS ON THE STERILIZATION OF FECES.

BY GEORGE M. STERNBERG.

In the experimental researches heretofore recorded in this series of papers, the germicidal value of various chemical reagents has been estab-

lished by biological tests made with pure cultures of various micro-organisms, or with "broken-down" beef tea. The latter test I consider the most difficult, as the putrid beef tea, after having been exposed in the laboratory for several days, contains a variety of micro-organisms, including several species of bacilli, especially *B. subtilis*, the spores of which have an extreme resistance. The results obtained in these experiments may, therefore, be safely used as a basis for determining the quantity of the chemical agents tested which will be necessary to sterilize *fluids* containing micro-organisms, when these fluids can be fairly compared with the putrid beef solution used in our experiments — due allowance being made on the side of safety when practical recommendations are to be made. The liquid discharges from the bowels of patients with cholera, typhoid fever, advanced tuberculosis, septic diarrhœa, etc., may be fairly compared with our broken-down beef tea, as regards physical and biological characters; and I should say, in general, that it would be within the limits of safety to prescribe twice the quantity of a given agent, for the disinfection of such material, that has been found necessary to sterilize the same amount of putrid beef stock.

But when we have to deal with formed or semi-solid fecal matter, the conditions are very different, and the data obtained in our experiments upon fluid material cannot be applied without making proper allowance for the larger amount of organic material associated with the germs which are to be destroyed, and for the fact that germs enclosed in masses of albuminous material may be protected from the action of the disinfecting agent. Especial care will be required in the practical use of the oxidizing disinfectants, such as potassium permanganate and the hypochlorites of lime and of soda. These agents owe their power to the fact that they are promptly decomposed by contact with organic matter, but this decomposition is entirely a chemical reaction, and only a given amount of organic material can be oxidized by a given quantity of the oxidizing agent; on the other hand, the disinfecting power of such agents is neutralized by a given quantity of organic material, whether this is in the form of living micro-organisms, or of dead animal or vegetable matter. If, then, the organic material is in excess, germs embedded in it will escape destruction, and the only safe rule in the practical use of oxidizing disinfectants is to *use such a quantity of the disinfecting agent that it shall be in excess after the reaction has taken place.*

The following experiments have been made for the purpose of determining within the limits necessary for practical purposes the quantity of the disinfecting solutions heretofore recommended by the Committee on Disinfectants required to sterilize a given quantity of feces (normal).

Standard Solution No. 1.

August 25.—Four ounces of semi-solid feces added to *one pint* of standard solution No. 1, available chlorine .65 per cent. At the end of twenty-four hours no chlorine remained in the mixture, and two culture-flasks inoculated with the material broke down—failure to sterilize.

August 28.—Four ounces of semi-solid feces added to *one quart* of standard solution No. 1, containing .85 per cent. of available chlorine. At the end of twenty-four hours a trace of chlorine (.01 per cent.) remained; there was no appearance or odor of feces in the mixture. No cultures were made in this experiment.

August 31.—Seven ounces of semi-solid feces added to *two quarts* of standard solution No. 1, available chlorine .83 per cent. At the end of one hour there was a trace of chlorine in the mixture. Two culture-flasks inoculated remained sterile.

September 5.—Two and one half ounces of semi-solid feces added to *one quart* of standard solution No. 1, available chlorine .9 per cent. At the end of one hour the mixture was found to contain .1 per cent. of available chlorine. Two culture-flasks were inoculated at the end of one hour: both broke down after remaining twenty-four hours in the oven. As both flasks contained a pure culture of *B. subtilis*, it was evident that this was the most resistant organism present in the material, and that all other organisms were destroyed.

September 7.—Six and one half ounces of semi-solid feces added to *two quarts* of standard solution No. 1, containing .9 per cent. of available chlorine. At the end of three hours the available chlorine present in the mixture was found to be .11 per cent., and at the end of twenty-four hours .1 per cent. Two tubes inoculated at the end of three hours remained sterile.

I conclude from these experiments that in practice it will be safe to use one quart of standard solution No. 1 for every two ounces of feces to be sterilized. Vallin estimates a complete (daily) evacuation of the bowels at from 150 to 200 grammes—say six to eight ounces. Let us keep on the safe side, and allow one gallon of this solution, containing four ounces of chloride of lime of the best quality, for the sterilization of a normal alvine evacuation. The daily cost *per capita* for sterilizing feces would then be less than one cent, for chloride of lime can be bought by the quantity for three and a half cents per pound.

Standard Solution No. 2.

August 30.—Two and one half ounces of semi-solid feces added to *one pint* of standard solution No. 2. The material was very completely deodorized by the potassium permanganate in the solution. A thorough admixture and breaking up of the fecal matter was effected in this and in the following experiments by stirring with a glass rod. Two culture-flasks were inoculated at the end of two hours; both remained sterile.

September 6.—Seven and one half ounces of semi-solid feces added to *one quart* of standard solution No. 2. There was a decided fecal odor at the end of twenty-four hours. Two culture-flasks inoculated at the end of twenty-four hours broke down with *B. termo*.

September 8.—Seven ounces of semi-solid feces added to *two quarts* of standard solution No. 2. Only a slight fecal odor at the end of twenty-four hours. A copper wire dipped into the mixture showed the presence

of a salt of mercury in solution—deposit of metallic mercury on wire. Two culture-tubes inoculated in twenty-four hours remained sterile.

Making a liberal allowance on the side of safety, we may say that one gallon of this standard solution, containing two drachms each of mercuric chloride and potassium permanganate, may be relied upon for sterilization and deodorization of a normal alvine evacuation. The cost would be about two cents, if the materials were purchased by the quantity, and the solution made (without expense for transportation) as required.

The following experiments have been made with a solution containing four ounces of mercuric chloride and one pound of cupric sulphate to the gallon of water (standard concentrated solution). For use, this standard solution is diluted by adding eight fluid ounces to the gallon of water.

August 29.—Eight ounces of semi-solid feces added to *one quart* of above solution. Fecal odor not destroyed as well as by standard solution No. 2. Two culture-flasks inoculated at the end of twenty-four hours remained sterile.

September 2.—Three ounces of formed feces added to *one quart* of the above mentioned solution. Two culture-flasks inoculated at the end of twenty-four hours remained sterile.

The following experiment has been made with solution of carbolic acid:

2d.—One and one half ounces of formed feces added to *one quart* of a 5 per cent. solution of carbolic acid. Two culture-flasks inoculated at the end of twenty-four hours broke down with *B. subtilis*, *a pure culture*, showing that the spores of this bacillus had not been killed, but that the material had been sterilized so far as *B. termo* and other putrefactive organisms present were concerned.

CONCLUSIONS.

The experimental evidence recorded in this report seems to justify the following conclusions:

The most useful agents for the destruction of spore-containing infectious material are,—

1. *Fire.* Complete destruction by burning.
2. *Steam under pressure.* 110° C. (230° Fahr.) for ten minutes.
3. *Boiling in water* for one hour.[1]
4. *Chloride of lime.*[2] A 4% solution.
5. *Mercuric Chloride.* A solution of 1 : 500.

For the destruction of infectious material which owes its infecting power to the presence of micro-organisms *not containing spores*, the committee recommends,—

1. *Fire.* Complete destruction by burning.

[1] This temperature does not destroy the spores of *B. subtilis* in the time mentioned, but is effective for the destruction of the spores of the anthrax bacillus and of all known pathogenic organisms.

[2] Should contain at least 25 per cent. of available chlorine.

2. *Boiling in water* half an hour.
3. *Dry heat.* 110° C. (230° Fahr.) for two hours.
4. *Chloride of lime.*[1] 1 to 4% solution.
5. *Solution of chlorinated soda.*[2] 5 to 20% solution.
6. *Mercuric chloride.* A solution of 1 : 1,000 to 1 : 4,000.
7. *Sulphur dioxide.* Exposure for 12 hours to an atmosphere containing at least 4 volumes per cent. of this gas, preferably in presence of moisture.[3]
8. *Carbolic acid.* 2 to 5% solution.
9. *Sulphate of copper.* 2 to 5% solution.
10. *Chloride of zinc.* 4 to 10% solution.

The Committee would make the following recommendations with reference to the practical application of these agents for disinfecting purposes:

FOR EXCRETA.

(a) In the sick-room. For spore-containing material:

1. Chloride of lime in solution, 4%.
2. Mercuric chloride in solution, 1 : 500.[4]

In the absence of spores:

3. Carbolic acid in solution, 5%.
4. Sulphate of copper in solution, 5%.
5. Chloride of zinc in solution, 10%.

(b) In privy vaults:

Mercuric chloride in solution, 1 : 500.[5]

(c) For the disinfection and deodorization of the surface of masses of organic material in privy vaults, etc.:

Chloride of lime in powder.[6]

FOR CLOTHING, BEDDING, ETC.

(a) Soiled under-clothing, bed linen, etc.:

1. Destruction by fire, if of little value.
2. Boiling for at least half an hour.
3. Immersion in a solution of mercuric chloride of the strength of 1 : 2,000 for four hours.[7]
4. Immersion in a 2% solution of carbolic acid for four hours.

[1] Should contain at least 25 per cent. of available chlorine.

[2] Should contain at least 3 per cent. of available chlorine.

[3] This will require the combustion of between 3 and 4 lbs. of sulphur for every 1,000 cubic feet of air space.

[4] The addition of an equal quantity of potassium permanganate as a deodorant, and to give color to the solution, is to be recommended (*Standard Solution No.* 2).

[5] A concentrated solution containing four ounces of mercuric chloride and one pound of cupric sulphate to the gallon of water is recommended as a *standard solution.* Eight ounces of this solution to the gallon of water will give a dilute solution for the disinfection of excreta, containing about 1 : 500 of mercuric chloride and 1 : 125 of cupric sulphate.

[6] For this purpose the chloride of lime may be diluted with plaster of Paris, or with clean, well dried sand, in the proportion of one part to nine.

[7] The blue solution containing sulphate of copper, diluted by adding two ounces of the concentrated solution to a gallon of water, may be used for this purpose.

(b) Outer garments of wool or silk, and similar articles, which would be injured by immersion in boiling water or in a disinfecting solution:

(1) Exposure to dry heat at a temperature of 110° C. (230° Fahr.) for two hours.

(2) Fumigation with sulphurous acid gas for at least twelve hours, the clothing being freely exposed, and the gas present in the disinfection chamber in the proportion of four volumes per cent.

(c) Mattresses and blankets soiled by the discharges of the sick:

1. Destruction by fire.
2. Exposure to super-heated steam—25 lbs. pressure—for one hour. (Mattresses to have the cover removed or freely opened.)
3. Immersion in boiling water for one hour.
4. Immersion in the blue solution (mercuric chloride and sulphate of copper), two fluid ounces to the gallon of water.

FURNITURE, AND ARTICLES OF WOOD, LEATHER, AND PORCELAIN.[1]

Washing, several times repeated, with,—

1. Solution of mercuric chloride 1 : 1,000. (The blue solution, four ounces to the gallon of water, may be used.)
2. Solution of chloride of lime, 1%.
3. Solution of carbolic acid, 2%.

FOR THE PERSON.

The hands and general surface of the body of attendants, of the sick, and of convalescents at the time of their discharge from hospital:

1. Solution of chlorinated soda diluted with nine parts of water (1 : 10).
2. Carbolic acid, 2% solution.
3. Mercuric chloride, 1 : 1,000; recommended only for the hands, or for washing away infectious material from a limited area, not as a bath for the entire surface of the body.

FOR THE DEAD.

Envelop the body in a sheet thoroughly saturated with,—

1. Chloride of lime in solution, 4%.
2. Mercuric chloride in solution, 1 : 500.
3. Carbolic acid in solution, 5%.

FOR THE SICK-ROOM AND HOSPITAL WARDS.

(a) While occupied, wash all surfaces with,—

1. Mercuric chloride in solution, 1 : 1,000. (The blue solution containing sulphate of copper may be used.)
2. Chloride of lime in solution, 1%.
3. Carbolic acid in solution, 2%.

(b) When vacated, fumigate with sulphur dioxide for 12 hours, burning 3 pounds of sulphur for every 1,000 cubic feet of air space in the

[1] For articles of metal, use Solution No. 3.

room; then wash all surfaces with one of the above-mentioned disinfecting solutions, and afterwards with soap and hot water; finally throw open doors and windows, and ventilate freely.

FOR MERCHANDISE AND THE MAILS.[1]

The disinfection of merchandise and of the mails will only be required under exceptional circumstances; free aeration will usually be sufficient. If disinfection seems necessary, fumigation with sulphur dioxide, as recommended for woollen clothing, etc., will be the only practicable method of accomplishing it.

RAGS.

(a) Rags which have been used for wiping away infectious discharges should at once be burned.

(b) Rags collected for the paper-makers during the prevalence of an epidemic should be disinfected before they are compressed in bales, by,—

1. Exposure to super-heated steam (25 lbs. pressure) for ten minutes.
2. Immersion in boiling water for half an hour.

(c) Rags in bales can only be disinfected by injecting super-heated steam (50 lbs. pressure) into the interior of the bale. The apparatus used must insure the penetration of the steam to every portion of the bale.

SHIPS.

(a) Infected ships at sea should be washed in every accessible place, and especially the localities occupied by the sick, with,—

1. Solution of mercuric chloride 1 : 1,000. (The blue solution heretofore recommended may be used.)
2. Solution of chloride of lime, 1%.
3. Solution of carbolic acid, 2%.

The bilge should be disinfected by the *liberal* use of a strong solution of mercuric chloride (the concentrated solution—"blue solution"—of this salt with cupric sulphate may be used).

(b) Upon arrival at a quarantine station an infected ship should at once be fumigated with sulphurous acid gas, using three pounds of sulphur for every 1,000 cubic feet of air space; the cargo should then be discharged on lighters; a liberal supply of the concentrated solution of mercuric chloride (4 oz. to the gallon) should be thrown into the bilge, and at the end of twenty-four hours the bilge-water should be pumped out and replaced with *pure* sea-water; this should be repeated. A second fumigation after the removal of the cargo is to be recommended; all accessible surfaces should be washed with one of the disinfecting solutions heretofore recommended, and subsequently with soap and hot water.

[1] In order to secure penetration of the envelope by the sulphur dioxide, all mail matter should be perforated by a cutting stamp before fumigating.

PRELIMINARY REPORT.

At the annual meeting of the Sanitary Council of the Mississippi Valley, held in New Orleans, La., March 10, 11, 1885, the following resolution was adopted:

"*Resolved*, That the secretary request from the chairman of the Committee on Disinfectants, appointed at the last meeting of the American Public Health Association, a plain, practical paper on 'Disinfection and Disinfectants,' for popular use and distribution, to be furnished to the chairman of the special committee of this council on General Sanitation."

In compliance with this request a Preliminary Report was prepared, which has been quite widely circulated. This report having been made before the experimental researches of the committee were completed, and being a "preliminary report," was only intended to serve a temporary purpose; but it has been thought best to revise it, and to introduce it into this our final report, so that it may be available for distribution in a separate form if sanitary officials find it suitable for popular use.

DISINFECTION AND DISINFECTANTS.

The object of *disinfection* is to prevent the extension of infectious diseases by destroying the specific infectious material which gives rise to them. This is accomplished by the use of *disinfectants*.

There can be no partial disinfection of such material; either its infecting power is destroyed, or it is not. In the latter case there is a failure to disinfect. Nor can there be any disinfection in the absence of infectious material.

It has been proved for several kinds of infectious material that its specific infecting power is due to the presence of living micro-organisms, known in a general way as "disease germs;" and practical sanitation is now based upon the belief that the infecting agents in all kinds of infectious material are of this nature. Disinfection, therefore, consists essentially in the destruction of disease germs.

Popularly, the term disinfection is used in a much broader sense. Any chemical agent which destroys or masks bad odors, or which arrests putrefactive decomposition, is spoken of as a disinfectant. And in the absence of any infectious disease it is common to speak of disinfecting a foul cesspool, or bad smelling stable, or privy vault.

This popular use of the term has led to much misapprehension, and the agents which have been found to destroy bad odors—*deodorizers*—or to arrest putrefactive decomposition—*antiseptics*—have been confidently recommended and extensively used for the destruction of disease germs in the excreta of patients with cholera, typhoid fever, etc.

The injurious consequences which are likely to result from such misapprehension and misuse of the word disinfectant will be appreciated when it is known that

Recent researches have demonstrated that many of the agents which

have been found useful as deodorizers, or as antiseptics, are entirely without value for the destruction of disease germs.

This is true, for example, as regards the sulphate of iron, or copperas, a salt which has been extensively used with the idea that it is a valuable disinfectant. As a matter of fact, sulphate of iron in saturated solution does not destroy the vitality of disease germs or the infecting power of material containing them. This salt is, nevertheless, a very valuable antiseptic, and its low price makes it one of the most available agents for the arrest of putrefactive decomposition in privy vaults, etc.

Antiseptic agents, however, exercise a restraining influence upon the development of disease germs, and their use during epidemics is to be recommended, when masses of organic material in the vicinity of human habitations cannot be completely destroyed, or removed, or disinfected.

While an antiseptic agent is not necessarily a disinfectant, all disinfectants are antiseptics; for putrefactive decomposition is due to the development of "germs" of the same class as that to which disease germs belong, and the agents which destroy the latter also destroy the bacteria of putrefaction, when brought in contact with them in sufficient quantity, or restrain their development when present in smaller amounts.

A large number of the proprietary "disinfectants," so called, which are in the market, are simply deodorizers or antiseptics, of greater or less value, and are entirely untrustworthy for disinfecting purposes.

Antiseptics are to be used at all times when it is impracticable to remove filth from the vicinity of human habitations, but they are a poor substitute for cleanliness.

During the prevalence of epidemic diseases, such as yellow fever, typhoid fever, and cholera, it is better to use in privy vaults, cesspools, etc., those antiseptics which are also disinfectants, *i. e.*, germicides; and when the contents of such receptacles are known to be infected, this becomes imperative.

Still more important is the destruction at our sea-port quarantine stations of infectious material which has its origin outside of the boundaries of the United States, and the destruction within our boundaries of infectious material given off from the persons of those attacked with any infectious disease, whether imported or of indigenous origin.

In the sick-room we have disease germs at an advantage, for we know where to find them, as well as how to kill them.

Having this knowledge, not to apply it would be criminal negligence, for our efforts to restrict the extension of infectious diseases must depend largely upon the proper use of disinfectants in the sick-room.

GENERAL DIRECTIONS.

Disinfection of excreta, etc.—The infectious character of the dejections of patients suffering from cholera and from typhoid fever is well established; and this is true of mild cases and of the earliest stages of these diseases, as well as of severe and fatal cases. It is probable that

epidemic dysentery, tuberculosis, and perhaps diphtheria, yellow fever, scarlet fever, and typhus fever, may also be transmitted by means of the alvine discharges of the sick. It is therefore of the first importance that these should be disinfected. In cholera, diphtheria, yellow fever, and scarlet fever, all vomited material should also be looked upon as infectious. And in tuberculosis, diphtheria, scarlet fever, and infectious pneumonia, the sputa of the sick should be disinfected or destroyed by fire. It seems advisable also to treat the urine of patients sick with an infectious disease, with one of the disinfecting solutions below recommended.

Chloride of lime, or bleaching powder, is, perhaps, entitled to the first place for disinfecting excreta, on account of the rapidity of its action. The following standard solution is recommended:

STANDARD SOLUTION NO. 1.

Dissolve Chloride of Lime of the best quality[1] *in pure water, in the proportion of four ounces to the gallon.*

Use one quart of this solution for the disinfection of each discharge in cholera, typhoid fever, etc.[2] Mix well, and leave in vessel for at least one hour before throwing into privy vault or water-closet. The same directions apply for the disinfection of vomited matters. Infected sputum should be discharged directly into a cup half full of the solution.

STANDARD SOLUTION NO. 2.

Dissolve Corrosive Sublimate and Permanganate of Potash in pure water, in the proportion of two drachms of each salt to the gallon.

This is to be used for the same purposes and in the same way as standard solution No. 1. It is equally effective, but it is necessary to leave it for a longer time in contact with the material to be disinfected — at least four hours. The only advantage which this solution has over the chloride of lime solution consists in the fact that it is odorless, while the odor of chlorine in the sick-room is considered by some persons objectionable. The cost is a little more.[3] It must be remembered that this solution is highly poisonous. It is proper, also, to call attention to the fact that *it will injure lead pipes if passed through them in considerable quantities.*

It will be best to empty the vessel containing excreta and disinfectant

[1] Good chloride of lime should contain at least 25 per cent. of available chlorine. (See *ante*, p. 203.) It may be purchased by the quantity at 3½ cents per pound. The cost of the standard solution recommended is, therefore, less than one cent a gallon. A clear solution may be obtained by filtration or by decantation, but the insoluble sediment does no harm, and this is an unnecessary refinement.

[2] For a very copious discharge, use a larger quantity. For the disinfection of solid or semi-solid feces, use a solution of twice this strength—8 oz. to a gallon of water—in the proportion of 1 quart for every 4 oz. of material to be disinfected.

[3] Corrosive sublimate costs about 70 cents a pound, and permanganate of potash 65 cents a pound, by the single pound. This makes the cost of standard solution No. 2 a little more than two cents a gallon.

into an earthen jar or wooden vessel, and to leave it for twenty-four hours, at the end of which time it may be thrown into a privy vault, or into a hole in the ground excavated for this special purpose.

Disinfection of the person.—The surface of the body of a sick person, or of his attendants, when soiled with infectious discharges, should be at once cleansed with a suitable disinfecting agent. For this purpose, solution of chlorinated soda *(liquor sodæ chlorinatæ)*, diluted with nine parts of water, or standard solution No. 1, diluted with three parts of water, may be used. A two per cent. solution of carbolic acid is also suitable for this purpose, and under proper supervision the use of a solution of corrosive sublimate (1 : 1,000) is to be recommended.

In diseases like small-pox and scarlet fever, in which the infectious agent is given off from the entire surface of the body, occasional ablutions with solution of chlorinated soda, diluted with twenty parts of water, will be more suitable than the stronger solution above recommended.

In all infectious diseases the body of the dead should be enveloped in a sheet saturated with standard solution No. 1, or with a 5 per cent. solulution of carbolic acid, or a 1 : 500 solution of corrosive sublimate.

Disinfection of clothing.—Boiling for half an hour will destroy the vitality of all known disease germs, and there is no better way of disinfecting clothing or bedding which can be washed than to put it through the ordinary operations of the laundry. No delay should occur, however, between the time of removing soiled clothing from the person or bed of the sick, and its immersion in boiling water, or in one of the following solutions; and no article should be permitted to leave the infected room until so treated.

STANDARD SOLUTION NO. 3.

Dissolve four ounces of Corrosive Sublimate and one pound of Sulphate of Copper in a gallon of water.

Two fluid ounces of this standard solution to the gallon of water will make a suitable solution for the disinfection of clothing. The articles to be disinfected must be thoroughly soaked with the disinfecting solution and left in it for at least two hours, after which they may be wrung out and sent to the wash.

N. B.—*Solutions of Corrosive Sublimate should not be placed in metal receptacles*, for the salt is decomposed and the mercury precipitated by contact with copper, lead, or tin. A wooden tub or earthen crock is a suitable receptacle for such solutions.

When diluted as directed, this solution may be used without danger from poisoning through the medium of clothing immersed in it, or by absorption through the hands in washing. A poisonous dose could scarcely be swallowed by mistake, owing to the metallic taste of the solution, and the considerable quantity which would be required to produce a fatal effect.

Clothing may also be disinfected by immersing it for four hours in a two per cent. solution of carbolic acid.

Clothing or bedding which cannot be washed, or subjected to the action

of steam, may be disinfected by exposure to dry heat in a properly constructed disinfecting chamber for three or four hours. A temperature of 230° Fahr. should be maintained during this time, and the clothing must be freely exposed, *i. e.*, not folded or arranged in piles or bundles, for the penetrating power of dry heat is very slight.[1]

The temperature above mentioned will not destroy the *spores* of bacilli, *e. g.*, of the anthrax bacillus, but is effective for the destruction of all disease germs which do not form spores; and there is good reason to believe that this list includes small-pox, cholera, yellow fever, diphtheria, erysipelas, puerperal fever, and scarlet fever (?). Moist heat is far more effective, and it is demonstrated that ten minutes' exposure to steam, at a temperature of 230° Fahr., will destroy all known disease germs, including the most refractory spores.

In the absence of a suitable chamber for the use of dry heat, fumigation with sulphurous acid gas may be resorted to. The room in which disinfection is practised should be hermetically closed to prevent the escape of the gas, and three pounds of sulphur should be burned in it for every 1,000 cubic feet of air space. Expose the articles to be disinfected as freely as possible by hanging them up in the disinfecting chamber, and leave them for at least twelve hours subjected to the action of the sulphurous acid gas.

Soiled mattresses, pillows, feather beds, and articles of this nature cannot be effectually disinfected by sulphur fumigation, owing to the fact that the gas does not penetrate to their interior in sufficient amount. For articles of this kind, and in general for articles of little value, which have been soiled by the discharges of the sick, destruction by fire will be advisable.

Disinfection of the sick-room.—In the sick-room no disinfectant can take the place of free ventilation and cleanliness. It is an axiom in sanitary science that *it is impracticable to disinfect an occupied apartment*, for the reason that disease germs are not destroyed by the presence in the atmosphere of any known disinfectant in respirable quantity. Bad odors may be neutralized, but this does not constitute disinfection in the sense in which the term is here used. These bad odors are, for the most part, an indication of want of cleanliness, or of proper ventilation; and it is better to turn contaminated air out of the window, or up the chimney, than to attempt to purify it by the use of volatile chemical agents, such as carbolic acid, chlorine, etc., which are all more or less offensive to the sick, and are useless so far as disinfection, properly so called, is concerned.

When an apartment which has been occupied by a person sick with an infectious disease is vacated, it should be disinfected.

The object of disinfection in the sick-room is, mainly, the destruction of infectious material attached to surfaces, or deposited as dust upon window-ledges, in crevices, etc. If the room has been properly cleansed and ventilated while still occupied by the sick person, and especially if it

[1] The limitations with reference to the use of dry heat as a disinfectant are stated in the paper on Dry Heat; see page 263, *ante*.

was stripped of carpets and unnecessary furniture at the outset of his attack, the difficulties of disinfection will be greatly reduced.

All surfaces should be thoroughly washed with standard solution No. 1, diluted with three parts of water, or with a 1 : 1,000 solution of corrosive sublimate. Standard solution No. 3, diluted in the proportion of four ounces to the gallon of water, may be used.

The walls and ceiling, if plastered, should be brushed over with one of these solutions, and subsequently washed over with a lime wash.

Especial care must be taken to wash away all dust from window ledges and other places where it may have settled, and to thoroughly cleanse crevices and out-of-the-way places. After this application of the disinfecting solution, and an interval of twenty-four hours or longer for free ventilation, the floors and wood-work should be well scrubbed with soap and hot water, and this should be followed by a second more prolonged exposure to fresh air, admitted through open doors and windows.

As an additional precaution, fumigation with sulphurous acid gas is to be recommended, especially for rooms which have been occupied by patients with small-pox, scarlet fever, diphtheria, typhus fever, and yellow fever. But fumigation with sulphurous acid gas alone, as commonly practised, cannot be relied upon for disinfection of the sick-room and its contents, including bedding, furniture, infected clothing, etc., as is popularly believed.

When fumigation is practised, it should precede the general washing with a disinfecting solution, heretofore recommended.

To ensure any results of value, it will be necessary to close the apartment to be disinfected as completely as possible, by stopping all apertures through which the gas might escape, and to burn not less than three pounds of sulphur for each thousand cubic feet of air space in the room. To secure complete combustion of the sulphur, it should be placed in powder or in small fragments in a shallow iron pan, which should be set upon a couple of bricks in a tub partly filled with water, to guard against fire. The sulphur should be thoroughly moistened with alcohol before igniting it.

Disinfection of privy vaults, cesspools, etc.—When the excreta (not previously disinfected) of patients with cholera or typhoid fever have been thrown into a privy vault, this is infected, and disinfection should be resorted to as soon as the fact is discovered, or whenever there is reasonable suspicion that such is the case. It will be advisable to take the same precautions with reference to privy vaults into which the excreta of yellow fever patients have been thrown, although we do not definitely know that this is infectious material.

The most trustworthy agent for this purpose is corrosive sublimate. The amount used must be proportioned to the amount of material to be disinfected.[1]

[1] Recent experiments made by Dr. Sternberg (see page 269 *et seq.*) make it apparent that the complete sterilization of large masses of fecal matter in privy vaults would be a difficult and expensive undertaking, if not entirely impracticable. It is therefore of prime importance that infectious

Use one pound of corrosive sublimate for every five hundred pounds (estimated) *of fecal matter contained in the vault.*

Solution No. 3, diluted with three parts of water, may be used. The diluted solution should be applied in the proportion of one gallon to every four gallons (estimated) of the contents of the vault.

All exposed portions of the vault and the wood-work above it should be thoroughly washed down with the disinfecting solution.

To keep a privy vault disinfected during the progress of an epidemic, sprinkle chloride of lime freely over the surface of its contents daily; or, if the odor of chlorine is objectionable, apply daily four or five gallons of standard solution No. 2, which should be made up by the barrel and kept in a convenient location for this purpose.

Disinfection of ingesta.—It is well established that cholera and typhoid fever are very frequently, and perhaps usually, transmitted through the medium of infected water or articles of food, and especially milk. Fortunately we have a simple means at hand for disinfecting such infected fluids. This consists in the application of heat. *The boiling temperature maintained for half an hour kills all known disease germs.* So far as the germs of cholera, yellow fever, and diphtheria are concerned, there is good reason to believe that a temperature considerably below the boiling point of water will destroy them. But in order to keep on the safe side, it is best not to trust anything short of the boiling point (212° Fahr.) when the object is to disinfect food or drink which is open to the suspicion of containing the germs of any infectious disease.

During the prevalence of an epidemic of cholera, it is well to boil all water for drinking purposes. After boiling, the water may be filtered, if necessary, to remove sediment, and then cooled with *pure* ice if desired.

George M. Sternberg.
Joseph H. Raymond.
Charles Smart.
Victor C. Vaughan.
A. R. Leeds.
W. H. Watkins.
George H. Rohé.

material should be destroyed before it is thrown into a receptacle of this kind. But it seems also important that, during the prevalence of an epidemic, the contents of privy vaults should be rendered unsuitable for the development of disease germs by the use of antiseptics, and that, so far as practicable, infectious material not previously disinfected should be destroyed *in situ*. A thorough disinfection of exposed surfaces soiled with the discharges of those who have recently frequented the place, and of the exposed surface of the material in the vault, is, perhaps, all that will be accomplished by the use of a solution of the bichloride of mercury, as recommended. But it is doubtful whether more would be accomplished by the use of any other disinfectant in reasonable quantity, and the superior potency of the bichloride as a germicide and antiseptic seems to the committee to justify the recommendation made with reference to its use in privy vaults. The liberal use of a good disinfecting powder upon the surface of such masses of organic material is also to be commended, and for this purpose chloride of lime, diluted with some inert substance, on the score of economy and efficiency, is, perhaps, the most useful agent. (See page 235.)

XXII.

THE DEBIT AND CREDIT ACCOUNT OF THE PLYMOUTH EPIDEMIC.

By BENJAMIN LEE, A. M., M. D., PH. D., Secretary of the State Board of Health of Pennsylvania.

Nearly in the geographical centre of Philadelphia lies a region which is unhappily typical of many other regions in that fair but filthy city, and which is thus described by Dr. Pemberton Dudley, a member of the State Board of Health, who, at my suggestion, made a careful inspection of the premises:

The house numbered "800" on East Girard avenue, is at the corner of this street, in the eighteenth ward. Girard avenue at this point runs from south-west to north-east, Otis street crossing it at right angles. The location of the house is properly described as on the east corner of the intersection. The premises are occupied by Mr. Thomas R. Jones as a cigar store and dwelling, and appear to be well kept and cleanly, so far at least as the internal arrangements are concerned.

Inquiry revealed the information that late in September, 1883, Mr. Reuben Reed, who worked at his trade (blacksmith) at a shop on Richmond street and boarded with Mr. Jones, was attacked with typhoid fever. Dr. A. H. Hulshizer, a well known physician residing at 1419 Otis street, was called, and recommended his immediate removal to the Episcopal hospital. This was done, the record-book showing the date to be September 28. He was discharged convalescent, October 13.

"In May or June, 1884," says Mrs. Thomas R. Jones, "Wm. P. Williams, aged twenty-three, a conductor on the Union line of street-cars and a boarder in Jones's house, was attacked with typhoid fever, was ill at the hospital for six or eight weeks, and then returned safe and sound" to his boarding-house. Dr. Hulshizer recommended him to the Episcopal hospital, but the hospital superintendent finds no record of the case upon the books of the institution. Soon after Mr. Williams's return from the hospital, namely, July 16, 1884, Mr. Meshak Davis, aged twenty-one, a huckster and a boarder at 800 East Girard avenue, was admitted to the Episcopal hospital with incipient typhoid fever. He also was discharged, recovered, August 19, 1884. These three cases embraced a period of about eleven months. The long space of time covered by them made it seem extremely improbable that they had originated from milk or other food contaminated by any single previous case of the disease, and I found no evidence to warrant such a theory. Neither did it appear likely that in the later cases the infection had been transmitted from the

earlier ones, since all of the first three patients were removed to the hospital at the outset of the disease. I therefore endeavored to learn whether any more constant cause existed to account for the succession of cases.

The lot upon which the house stands has dimensions of about thirty feet on Otis street by forty feet on Girard avenue. The main building is a three-story brick structure, of eighteen feet front on Otis street and extending the entire depth of the lot on the Girard avenue side, leaving a side yard 12×40 feet. Directly across this space a one-story frame kitchen has been erected, leaving in front of it a yard 12×16 feet opening upon Otis street, and back of it another space 12×15 feet. This rear space, however, has been further encroached upon by the erection of a two-story frame structure, which leaves only a narrow space 15×3 feet. At the rear end of this "yard" stands a yard-privy, three feet square, which still further reduces the open space to 3×12 feet. The lower story of the frame building communicated with the kitchen, and is used as a dining-room. Its windows open into the narrow yard, close to the privy vault. The opposite side of the yard is closed in by the two-story walls of the adjoining house, while its rear end is also guarded by a wall of similar height, belonging to the house numbered 802 Girard avenue. The privy itself is built of boards, is surmounted by a "ventilator" (which on examination was found to be a sham), and is poised over a shallow vault which also serves for the use of the house adjoining.

We thus see that the cesspool is located in and occupies one fifth of a space 15×3 feet in dimensions; that this space is enclosed on both sides and one end by two-story buildings, and at the remaining end by a one-story building, and is thus effectually protected from lateral air currents. The foul emanations fill up the entire space, and too often find an escape into the kitchen and dining-room with which it directly communicates. If the whole yard were one large cesspool, with dining-room windows and kitchen door opening into it, it might be somewhat more offensive, but could scarcely be more dangerous. The cesspool was "cleaned," or emptied, in the summer of 1884. At the time of my inspection it was almost full again. There is no sewer connection with the room (third story front) in which the four victims slept. The only connection between the house and the sewer is through a pipe leading from the kitchen sink through the cellar to a sewer on Otis street. This sewer comes up Otis street to a point somewhat below the house in question. The cellar of the Jones house and those of the three houses eastward on Otis street are affected with offensive odors at times, and the tenants frequently complain about them. The entire neighborhood is riddled with cesspools, the majority of which are in an unsanitary state most of the time. The houses on Ash street, a street running parallel to Otis and a few rods north-east of it, are in even a worse condition than those in Otis street, and evidently from the same cause, namely, defective drainage due to a badly arranged sewer. I learned that in the house on the opposite side of Otis street there have been three cases of typhoid fever within a few years, all of the patients being new comers in the neighborhood.

I was unable to learn what the sanitary condition of the premises had been in the past, but at present I can find nothing to criticise unfavorably. There appears to be no unusual ill-health prevalent in the vicinity.

From all the information I could gather by means of personal inspection, and diligent inquiry of neighboring physicians and other observant citizens, I have not the slightest doubt that while there are numerous and glaring unsanitary conditions in the vicinity, the real cause of the cases of typhoid fever occurring in Thomas R. Jones's house is to be found in the grossly defective cesspool, with its foul exhalations completely shut in from lateral air currents, and pouring through open doors and windows into the kitchen and dining-room, to be inspired by the inmates, or worse still, to be absorbed by the food in course of preparation for the table, and thus brought in contact with the alimentary mucus membrane. It is proper to state in conclusion, that the dangerous character of this particular cesspool cannot be abated or removed by any amount of "cleansing" or emptying, however frequently performed. Its complete abolition alone can bring safety to the household.

Into this house, with its history of fever and its foul environment, late in December, 1884, came David Jones, fresh from his mountain home, overlooking the vale of Wyoming, to visit his city brother and spend his Christmas holidays. Forth from this house early in January, 1885, again he went, but went not as he came. A poisoned blood now coursed through his veins; and shortly after returning to his home he was prostrated with what his physician soon pronounced typhoid fever, and lay on his back for many weeks, in his cottage on the banks of a little stream which supplies the reservoir of the town at the foot of the mountain. For the following facts I am indebted to Dr. Taylor, of Wilkes-Barre, who, at my request, has prepared an elaborate history of the epidemic for the use of the State Board of Health of Pennsylvania.

The maximum temperature was, on March 26, 46.5°; March 27, 56°; March 28, 43°; March 29, 37°,—increasing rapidly until April 4, when a temperature of 70° was reached.

March 26, with a maximum temperature of 46.5°, is the first day on which any considerable thaw could occur. Upon the evening of this day the superintendent of the water company visited the reservoir to ascertain whether it would be allowable to discontinue the pumping of river water. He found the first and second reservoirs almost entirely empty, while the third was filling rapidly, the short pipe, which allows the water to discharge from the bottom of the third into the stream leading to the second reservoir, being tightly frozen. He caused a fire to be built to melt the ice in this pipe, and then stopped the river pumps—the honest act of an honest man, bent simply on the discharge of his duty, and with kindliest intent. But of what a catastrophe was he the unconscious usher and hastener. The water, with its accumulated typhoid fever poison, was discharged from the bottom of the third res-

ervoir, ran down to the second, on to the first, and was thence distributed to the town, in all probability between the 28th of March and the 4th and 5th of April. Let us now turn our attention for a minute to the unsuspecting hamlet at the foot of the hill, over which hangs so terrible a doom. Plymouth, a mining town of some eight or nine thousand inhabitants, is situated in the Wyoming coal region of Pennsylvania, in Luzerne county, upon the right bank of the Susquehanna river, three miles below the city of Wilkes-Barre.

Owing to the development of coal lands, it has grown within a few years from an insignificant village to its present proportions; but its progress in science and improvement has not kept pace with its material development. A large portion of the town is built along the main street, which extends for more than a mile nearly parallel with and close to the Susquehanna river. As the town has grown, it has gradually extended backwards towards the hills beyond, which in the main part of the town, even a short distance from Main street, rise somewhat abruptly towards the north, so that Back street, although not far removed from the river, is nevertheless situated a number of feet higher. As a large part of the town is thus upon a side hill, there is but little difficulty in disposing of surface-water, which readily finds its way into the Susquehanna. No system of sewers and no effort at systematic drainage have ever been introduced, and the borough council seem singularly apathetic in the matter of sanitary reform. The drainage from each house is into cess-pools situated in the back yard, or, in some cases, it is even into the streets themselves, which in parts of the town have not a proper arrangement of gutters for disposal of this drainage.

The health of the town, however, in past years, has not been greatly different from that of other neighboring towns of the Wyoming valley similarly situated, and inhabited by a similar class of people. It is true that malarial diseases have been prevalent at different times, and each year has furnished quite a number of cases of typhoid fever; but at no time in previous years has the latter disease been so prevalent as to be regarded with alarm, either by the physicians themselves, or by the people at large. When, therefore, about two weeks after the incident I have mentioned, the epidemic in question appeared, and the inhabitants were stricken down by the hundreds in a very few days, great consternation followed among the people, and the inquiries were naturally made on all sides,—

1. What is this terrible sickness that is upon us?
2. What is the cause of so unusual an outbreak?

It appeared suddenly, following upon a few days of warm weather, which had caused the breaking up of the ice upon the river and the melting of large quantities of snow upon the hill-sides. Its ravages were not confined to any section of the town nor to any class of people, but the rich and the poor, the clean and the unclean, were alike attacked. From careful inquiry made early in May, I ascertained from the physicians of Plymouth that the first case belonging to this epidemic occurred

on April 9, and that from this time on the disease spread rapidly. During the week beginning April 12, from fifty to one hundred new cases appeared daily, and on one day, it is said, two hundred new cases were reported. In the early history of the epidemic, so severe were the symptoms, and so alarmingly rapid was the spread of the disease, that some doubts as to diagnosis prevailed for a short time, even among some of the medical gentlemen in attendance. It was variously declared to be typhoid fever, malarial fever, typho-malarial fever, and typho-malarial meningitis; but in a very short time its nature was made manifest, and the doubts no longer existed that a true epidemic of typhoid fever was hanging over the doomed borough of Plymouth. The first post-mortem examination was secured only after urgent solicitation, the people being singularly averse to any such examination, notwithstanding many had already died. This autopsy was conducted by Dr. E. O. Shakespeare, of Philadelphia, on May 10, in the presence of several physicians from Wilkes-Barre and Plymouth. Two other examinations were made on the following day, by Drs. Shakespeare and French, and in every case the characteristic lesions of Peyers' glands were found. If doubt as to diagnosis lingered in the minds of any, it was finally dissipated when these autopsies showed the disease to be genuine typhoid fever, and thus answered the first question. In considering the possibility of one patient's poisoning more than a thousand in Plymouth, we must bear in mind all the attending circumstances:

1. The accumulation of weeks, which equalled the dejecta from many ordinary patients, and which lay for a time dormant upon the snow and frozen ground.

2. The nearness to the stream. The house is so situated that all of the excreta was thrown within a few yards of its banks, and the conformation of the ground is such that its surface-water could not possibly drain in any other direction.

3. The unusually warm weather, which caused a sudden thaw, and poured the surface-water into the empty reservoir.

4. The concentration of the poison in a small amount of water.

5. The short distance to the town; and, finally, the possible preparation of the soil for the reception of this seed, which sprang at once into vigorous growth, and ripened for an abundant harvest of death.

As for the second, no link is wanting in the chain of evidence to show that the epidemic was due to the contamination, by the stools of that single patient, of the stream supplying the reservoir several miles distant from the town. The magnitude of the epidemic, and the clearly defined relations existing between the first and the succeeding cases, combine to make this one of the most instructive as well as one of the most terrible instances which ignorance and negligence have contributed to the records of disease.

Other investigations have been made, and the same conclusions have invariably followed, except in one instance. Dr. Torry, of Scranton, in the New York *Medical Record*, considers four factors to have been

active in the production of the epidemic, viz., polluted mountain water, polluted river water, polluted milk, and polluted air. This, so far as I know, is the only article published by any investigator, expressing views different from those contained in this paper.

The epidemic, as stated, began early in April, and continued with diminished virulence on through the spring and summer, and even into the fall months. This continuance was not due to the first cause, but in great measure, no doubt, to secondary infection. Even after the nature of the sickness became known, and its cause fully explained, great carelessness still prevailed among the people in regard to disposing of excreta; and even physicians themselves did not all exercise such care as the urgency of the case demanded.

There were in all 1,104 patients ill with the fever in Plymouth who properly came under the head of this epidemic. There were other names reported, but some of them were down as having been attacked in March; and two, as begun in February. Clearly, these should be ruled out of the reported number.

It is true that the date of the attack in each case was not gathered by the committees until September, and some allowance should be made for forgetfulness on the part of patients, but as it was clearly shown from the testimony of all the physicians in attendance that the epidemic did not begin until April, the cases reported for March either really belong to April, or do not belong to this epidemic at all. Of these 1,104 cases,

713 were taken sick in April,
261 " " May,
83 " " June,
31 " " July,
15 " " August,
1 " " September,

thus showing at a glance the great virulence of the poison contained in the water in the early days of April. If to the above number we add those who were taken ill in Plymouth and went to Wilkes-Barre and other places to be cared for, and also the visitors who took the poison in Plymouth and in whom the fever developed at their own homes, we shall find the actual number of persons affected considerably over 1,100. There were 605 males and 499 females. Up to October 1 there were 114 deaths, or a mortality of nearly 10⅓ per cent. The average age of those who died was 24.05 years, and the average duration of illness, 3.33 weeks. Of the 990 who recovered, the average duration of sickness was 8.28 weeks; but this no doubt is meant to include convalescents as well.

Dr. Morris Stroud French, of Philadelphia, one of the physicians sent up by the Citizens' Relief Committee of Philadelphia to assist in establishing a hospital and supplying food and medicines to the destitute and fever-stricken inhabitants, says,—"I would say that the total number of sick was 1,153, the population being estimated at 8,000. Of those attacked with the disease, 114 died. The proportion of deaths under treatment in the hospital was about 3 per cent., which is unsurpassed by

the records of any hospital in the world." At my request Dr. French undertook an inquiry into the financial outlay necessitated by the epidemic. The work was done by ward committees of the inhabitants, and the record comprises the names of all the sick, by wards, their ages and duration of illness, the number of deaths, the money actually expended in each case, the loss of earnings during illness, and the loss of earnings of those who died, but not the estimated value of the lives of the decedents. The expenses of the hospital are also given. The actual outlay is thus found to have been $67,100.17, of which amount $8,000 was expended in establishing and carrying on the hospital. Of those who recovered, the loss of earnings during illness was $30,020.08, making the total cost of the epidemic $97,120.25. It will be observed that this is actual hard cash, not an estimate. By the 114 deaths, monthly wages to the amount of $1,534.96 ceased, showing a loss of yearly income of $18,419.52.

The state of Pennsylvania contributed $5,000, the amount of her appropriation for the expenses of the state board of health for an entire year, to the support of this single hospital for a few weeks. I append Dr. French's table of totals, by wards.

Stimulated by the universal excitement and apprehension produced by this startling outbreak, the legislature of the state at length yielded to the solicitation of physicians and philanthropists who had for the past twelve years been asking for the establishment of a central bureau for the protection of her sanitary interests, and thus out of the agonies of Plymouth was the State Board of Health of Pennsylvania born. It is for that board to show on which side of the debit and credit sheet the balance should be struck.

TABULAR STATEMENT

of the Cost of the Plymouth Epidemic, by Wards.

No.		Died.	Cost of sickness.	Loss per mo. of those who died.	Loss of earnings during sickness.
138	1st ward, ...	14	$5,094.00	$39.00	$3,401.00
67	2d ward, ...	7	1,466.35	....	1,058.00
227	3d ward, ...	17	14,511.25	....	6,694.00
134	4th ward, ...	20	12,019.00	286.00	1,852.00
156	5th ward, ...	20	7,239.36	575.00	4,476.00
157	6th ward, ...	7	7,079.00	94.96	3,919.58
60	7th ward, ...	7	2,650.00	100.00	1,433.00
63	8th ward, ...	4	2,754.00	130.00	2,533.00
82	Turkey Hill district, ...	10	3,171.50	238.00	3,372.50
49	Township 2d Dist., East Div.,	3	2,016.00	....	1,159.00
20	Welsh Hill district, ...	5	1,099.71	72.00	122.00
1153		114	$59,100.17	$1,534.96	$30,020.08

Hospital (about)	$8,000.00
	$67,100.17
Loss earnings,	30,020.08
Grand total :	$97,120.25

DR. PLYMOUTH TYPHOID EPIDEMIC OF 1884. CR.

To expenses of 1153 sick at their homes,	$59,100.17	BY A
" expenses of 1153 sick at hospital, .	8,000.00	STATE BOARD
" loss of earnings during sickness, . .	30,020.08	OF
" loss of annual earnings of 114 decedents, ...	18,419.52	HEALTH, FOR
Total loss, neglecting value of lives and injury to all business interests,	$115,539.77	PENNSYLVANIA.

PROCEEDINGS AND DISCUSSIONS AT THE THIRTEENTH ANNUAL MEETING,

HELD AT

WASHINGTON, D. C., DECEMBER 8–11, 1885.

TUESDAY, December 8, 1885.

The thirteenth annual session of the American Public Health Association was called to order by the President, Dr. J. E. Reeves, at 10 o'clock A.M., Tuesday, December 8, at Washington, D. C., being the time and place agreed upon by the association at its last meeting.

The PRESIDENT.—Gentlemen of the Association: The hour of 10 o'clock having arrived, the association is now called to order, and the first thing in order will be the reading of the report of the Committee of Arrangements by the chairman of the committee, Dr. Smith Townshend, of Washington, D. C.

Dr. SMITH TOWNSHEND.—Gentlemen of the Association: It affords me pleasure to greet so many familiar faces at our thirteenth annual conference. Your committee have not accomplished all that they have desired. Some of the railroads of the city have offered to us the usual facilities for the members of the association, and some of them have refused to do so. I regret to say that in this respect the railroads of New England, with all their facilities, do not compare favorably with the South and West. We have however done all in our power, and I trust that our efforts may meet with your approbation. Knowing the value of your time and the work before you, I will not detain you any longer, but will say before closing my report that our city railroads—the street railways—have been very liberal in their offers to the association, some of them having furnished tickets for each member of the association, and other lines will allow members to ride free upon exhibiting their badges. I will say further, that the trustees of the Corcoran Art Gallery have extended to us an invitation to visit their institution at our pleasure. The Museum of Hygiene, which is one of the most interesting buildings in our city, will throw its doors open every day, and the members of the association will have free ingress and egress. The printed programmes which have been distributed will tell the balance of what I would say.

The PRESIDENT.—The next thing in order is the report of the Secretary.

The Secretary read a telegram addressed to the President of the American Public Health Association, and dated Montreal, December 7, 1885,

from Mr. Henry R. Gray, chairman of the Board of Health of Montreal, sending best wishes for the success of the meeting, and regretting his inability to spare a member from his force of duty to attend the meeting because of the outbreak of small-pox in Montreal.

The SECRETARY.—A letter has been received from Dr. W. S. Robertson, in which he states his regrets at not being able to be present at the meeting of the association. He is kept away by sickness.

I will now present the proposed amendment to the constitution which was presented to the association last year, and which has laid over one year as required by the constitution. (The amendments may be found in Vol. X.)

The PRESIDENT.—You have heard the proposed amendments to the constitution. What is your pleasure?

Dr. GIHON.—I move, sir, that they be accepted and approved, and that a vote be taken on each separate amendment. I make that motion.

The SECRETARY.—I would like to say here that these amendments have received the careful consideration of the Executive Committee, that they have been one year before the board, as the constitution requires, and that they are believed to be in the interest of the American Public Health Association.

Dr. HIBBERD.—Mr. President, you may cast the vote for the association, if there is no objection.

The PRESIDENT.—Any gentlemen having objection may make it known.

Dr. KNIGHT.—I think it would be necessary to amend the provision in the amendments in regard to standing committees. The proposed amendments table three standing committees. The Committee on Incorporation have found it will be necessary to have a permanent Committee on Incorporation. By these amendments it will be necessary for us to renew the incorporation committee year by year. That will compel us to have an additional standing committee.

The PRESIDENT.—Gentlemen, the question arises here, and very properly, that any amendments proposed to the constitution, which have not been considered, must lie over one year, and I see no way out of this difficulty except that the amendments as originally proposed shall be adopted.

Dr. E. M. HUNT.—Is it the general rule of the association that an amendment must lie over a year? I have not so understood it.

The PRESIDENT.—It is the pleasure of the association to decide that question, but I shall so rule.

Dr. HUNT.—I recall one instance where that very thing was done, and the amendment did not have to lie over a year.

The PRESIDENT.—I submit, gentlemen of the association, that our constitution carefully provides that any amendments or changes must lie over for the space of one year for consideration. You can see very readily how that provision could be taken advantage of. If a mere outline could be proposed as an amendment, and if it could be adopted at

once without consideration, the whole character of our association could be changed.

Dr. Quimby.—I merely want to strengthen the point of my colleague from New Jersey, that where the amendments have been considered, and where it is desired to have but a simple alteration of what has already been considered, it is not necessary that it should lie over a year. That would block all legislation. I think that Dr. Hunt has the proper understanding of the matter.

Dr. Bailey.—I make a point of order—

The President.—This is no arbitrary ruling, and if you will permit the Chair to suggest that this question might be—

Dr. Rohé.—I would suggest that the amendments be taken up, one by one, in the regular order. It seems to me that this will save time.

The President.—The amendments will be taken up in their regular order. Amendment No. 1 will be first disposed of. The Secretary will please read it.

Dr. McCormack.—I move as a substitute to the motion already offered, that these amendments be voted upon as a whole.

The motion of Dr. McCormack was carried, and the amendments were voted upon as a whole, and adopted.

The Secretary.—I have here the names of members of the National Association of Master Plumbers, who made application for membership at St. Louis immediately after the adjournment of our association. (For names, see Vol. X, page 536.)

The President.—Gentlemen, you have heard the names of the gentlemen who have been proposed for membership. What is your pleasure?

On motion, the gentlemen whose names were read were admitted as members into the association.

The Secretary.—I have here the names of gentlemen who have been recommended by the Executive Committee. (The names of the applicants were read.)

On motion, the gentlemen whose names were read were admitted as members into the association.

Dr. Kedzie.—I would like to know whether these names are put in for active or associate membership.

The President.—That division has already been made and arranged for.

Dr. Kedzie.—Ought not the persons named to be elected by ballot?

The President.—That is the usual way.

Dr. Kedzie.—I move that the Secretary be instructed to cast the ballot of the association for the persons named.

The motion was put and carried, and the Secretary cast the ballot of the association as instructed, and the persons named were declared duly elected members of the association.

The report of the Committee on Necrology was then made by Dr. Irving A. Watson, secretary of the State Board of Health of New Hampshire, chairman. (See report elsewhere.)

The PRESIDENT.—The next business in order will be the reading of the Treasurer's report.

The report was then read by the Treasurer, Dr. Lindsley. (See report elsewhere.)

On motion, the report was received and referred to the Auditing Committee.

Dr. GIHON.—I think, sir, you have passed the report of the Committee on Incorporation.

The PRESIDENT.—The report of the Committee on Incorporation is now in order.

Dr. SMART.—The Committee on Incorporation present this report. (See report of Committees.)

Dr. GIHON.—I move that the report be accepted.

Dr. HEWITT.—There should also be incorporated in that resolution an order that the committee be one of the standing committees of the association. The committee should be continued.

Mr. BROOKS.—The first motion is the acceptance of the report.

The motion was put, and the report was accepted.

Dr. GIHON.—I ask whether it will be in order to move a reconsideration of that part of the constitution, so that we may make an amendment to the constitution now, and create this a standing committee.

The PRESIDENT.—If there be no objection, I think it can be done.

Dr. McCORMACK.—It appears to me the motion to reconsider is not consistent with the ruling the Chair made awhile ago, that any amendment submitted to the constitution should lie over for one year, and if we reconsider, and Dr. Gihon's resolution is again submitted, we will be where we were when you made the first ruling.

The PRESIDENT.—The Chair specifically stated that he had no choice in the matter. It was simply a suggestion that occurred to him, and if it was your pleasure to differ, he would be glad to have you so express it. It seems to me now we must make a virtue of necessity, and I think it would be wise for you to disregard the ruling of the Chair, if such an impression was made on the minds of the members as has been suggested.

Dr. GIHON.—I do not think the Chair made such a ruling. I do not think the Chair intended to rule that way.

Dr. REED, of Ohio.—We have accepted this report. Now if we adopt the report, we simply adopt what has been read, and it is stated there that there shall be a committee of a certain character to represent this society or association for the next ninety-nine years. If we adopt it, it becomes a part of our constitution. I cannot conceive of it in any other light. If we adopt the report, we will stop this technical trouble, for the report states that there shall be a standing committee; and therefore I move you that this report be adopted.

A MEMBER.—It has been adopted.

Dr. REED.—It was only accepted. It was suggested by my friend on the stand that it be accepted.

Mr. BROOKS.—It has not been adopted.

Dr. Billings.—I wish to suggest, Mr. President, that there is no use for delay if there is no question about having this as one of the standing committees. Let the formal amendment be proposed now, and in the meantime appoint a committee for one year. I therefore move that the Committee on Incorporation be continued for one year, and then that the amendment to the constitution making this one of the standing committees lie over for the constitutional period.

Dr. Gihon.—It will be necessary that we again continue this same Committee on Incorporation. We have got to change the committees. That is the necessity for having a standing Committee on Incorporation. We have got to change the president, and possibly the secretary and treasurer. We have got to change the *personnel* of the committee every year—from year to year.

The President.—I will say, for the information of the association, that my impression is, all that is necessary to meet the suggested difficulty will be for the Secretary of the association to make an affidavit of the fact of the change, and file such a paper with the proper officer in Washington.

Dr. Hibberd.—This committee is to be continued. If there is anything the matter with the *personnel* of it, it can be filled up just as it was last year, precisely.

Dr. Billings's motion was then put and carried.

The President.—The next business in order is the report of the Special Committee on Disinfectants.

Dr. Gihon.—Will you allow me to say that the roll of the Advisory Council has not been called?

The President.—This is the order now.

Dr. Rohé.—I hold in my hand the report of the Committee on Disinfectants for the last year. I do not propose to read it. A sufficient number have been printed for the use of the members of the association, to furnish every member of the association with a copy. I will ask now that an hour be fixed for the discussion of this report—not that it be discussed now, but that every member may have a chance to read it, or such portions of it as he may desire, that it may be discussed intelligently and with a knowledge of what the committee does report upon. I will ask particularly that every member read the resolutions which are prefixed to the report, which were offered last year by Dr. Hibberd, of Indiana, and which define the sphere of the committee's work. Then read the introductory remarks of the chairman, and incidentally pay some attention to the financial statement, showing what has been done, what money has been collected, where it has been collected, and how it has been expended. Read also the preliminary remarks of the chairman, in order that the limits which the committee set for its work may be distinctly understood, then read what the committee proposed to do, and then return to the conclusions on page 123, and read those conclusions. If they find that they do not understand upon what data the conclusions were based, then turn to that part of the report

marked "Experimental Data," running from page 3 to page 120, and read over and study carefully the work that has been done by that committee.

I do not want to take up the time, but ask especially that the members consider exactly what the committee proposes to do, and that they consider also what the committee has done. Then if any discussion takes place, it could be done rationally, and the time of the association not wasted by desultory questions and unconsidered remarks.

If convenient, I would ask the Executive Committee to fix an hour on Thursday when the discussion can take place. The copies of the report are on the stand in the hall-way. If it is preferred, they can be distributed to the members in the hall. I think that will not be so good, probably, because it might detract from the reading of the papers that follow. I am sorry Dr. Sternberg is not here. He is now on his way from Europe, and in his name and in the name of the committee I will present this report.

The President.—The next business will be the call of the Advisory Council by the Secretary. (Roll called.)

Dr. Gihon.—Allow me to suggest that the Dominion of Canada has not been called.

The President.—That will be in order a little later. The reading of the papers is next in order.

Dr. Reed.—I would like to ask if the report of the Committee on Incorporation has been adopted.

The President.—It has, with the amendment. The first paper in order is "Statistics of Consumption in Rhode Island for a Quarter of a Century," by Charles H. Fisher, M.D., of Providence, secretary of the State Board of Health of Rhode Island. (See page 41.)

Dr. Fisher not being present, the next paper in order, "Sanitary and Statistical Nomenclature," by E. M. Hunt, M.D., secretary of the State Board of Health of New Jersey, was then read. (See page 31.)

The President (after the reading of the paper).—I presume it is your pleasure that this paper shall take the ordinary course. Chair hearing no objection, it is so ordered.

Dr. Armstrong.—Is discussion on Dr. Hunt's paper out of order?

The President.—The rule is, that discussion shall not take place until all the papers of a group have been read.

Dr. Armstrong.—I do not think any such rule was in force at the St. Louis meeting.

Dr. Gihon.—I think the rule is, that all papers on collateral subjects are read, and then the discussion takes place at the end of the group. The discussion would follow here at the end of all the statistical papers.

The President.—That is the opinion of the Chair, and Dr. Billings will now read his paper on "Forms of Tables for Vital Statistics." (See page 51.)

Dr. Armstrong.—In relation to the very interesting paper presented by Dr. Hunt, of New Jersey, I should like to call the attention of the

association to the nomenclature of the College of Physicians and Surgeons of England as being one of the most satisfactory for recording disease and for use in health reports, both for states and municipalities as well as for institutions, that I am acquainted with. An experience of some five years' use with that form of nomenclature, and a comparison of statistics collected under it with the statistics collected under the usual tables, or, rather, the variety of tables, adopted by the different states and municipalities on this subject, show the necessity of some uniformity in the matter.

In regard to Dr. Hunt's paper in particular, while some of the suggestions are admirable, I think the question of the collection of the different diseases under special headings, and the advisability of collecting diseases as under the names pertaining to the particular localities, had better be left out. It is in the book I refer to. The diseases are collected under the general headings, and then under specific headings as diseases of the nervous system, etc. Certainly for reference this is a more satisfactory and desirable arrangement than any other I know of.

I would offer a motion for the consideration of this association, and this same motion was adopted by the American Medical Association ten years ago. I move that this association recommend that state boards of health adopt the nomenclature I have referred to above as officinal in making their reports.

The PRESIDENT.—That motion will take the usual reference. The question is still open for discussion. (After a pause.) If there are no further remarks on this general subject, Dr. Baker's paper will be read. (See page 154.)

Dr. BAKER.—Before reading my paper I will distribute a lot of diagrams, to which I ask the attention of the association. In this diagram is a condensed view of over 600,000 deaths. It is only just that I state the source of the information. I take the facts for the deaths from a book by Dr. Cunningham, surgeon of the Health Service of India. The diagram also shows a line representing the rain-fall in that area for forty-eight years, taken from the report of the health officer of the city of Calcutta, India. My paper is explanatory of the table and diagram.

The PRESIDENT.—You have heard Dr. Baker's paper, and the subject is open for discussion. (After a pause.) I hope gentlemen will avail themselves of the opportunity to discuss these important matters. One of the objects of reading the papers is to bring out the various views on the matter presented. We have a stenographer present for the purpose of reporting these discussions.

The next paper read was that of Dr. D. E. Salmon on the "Virus of Hog Cholera." (See page 73.)

The PRESIDENT.—Are there any remarks on Dr. Salmon's paper?

Dr. HUNT.—I beg to inquire whether the investigation made by the Bureau of Animal Industry has led to the conclusion arrived at by Klein —that it is the same form of microbe that he states is the cause of cholera.

Dr. Salmon.—As I stated in my paper, the organism Klein described in his last paper from its form appeared to be very similar if not identical with the one we are working with. I was struck by the fact that Klein stated that the germ with which he experimented had no effect on pigeons. We have inoculated two pigeons with the germ we are studying now. One of these died and the other is very sick. The germ we are experimenting with appears to be identical with the one which Thuillier described in France, and it may be identical with the one Klein has described, and he may possibly be mistaken as to its effects on pigeons. So far as the form goes, it may well pass for the germ we are now working with.

Dr. Reed.—I cannot pass this paper by without a remark or two in its favor; and I only wish to add that this paper is an argument in favor of more definite practical action in our states all over the United States for the protection of the people against this disease. If there is any such protection, I am not aware of it. There should be inspectors appointed to visit the slaughter-houses and inspect the swine or other animals liable to this disease, and see that animals infected are not killed and placed in the market. There is no question as to the value of this paper. The only question is, How are we going to make this paper practical? There is no question that there are many slaughter-houses all over our country that do their killing promiscuously. They do not know and do not care what kind of animal is put on the market; and from the amount of pork used in our country to-day there certainly is a demand for some precaution, and it is necessary to have such protection to prevent the killing of animals infected with this disease, and the selling of meat to the people at large that is infected. I think that it is highly necessary our state boards of health should take such action as is essential to prevent the killing of these animals and the spread or possible spread of these diseases among the people. I speak from experience in our own state, Ohio. I do not see why Ohio should not be brought up as an example, for we have been fighting for a health board in our state and have been unsuccessful. We have no protection in these matters in our city. We cannot get our municipal officers to pass any law to protect us in regard to our meats, or to take any interest in sanitary matters. Political reasons, financial reasons, and various other reasons prevent us from getting what we should have, and what I think to be highly essential. I know of instances in our own town where diseased cattle have been put on our markets, and there was no protection against it. I am highly in favor of adopting some measure by which this matter can be remedied.

A Member.—Did the people who ate the diseased meat suffer from it?

Dr. Reed.—I could not answer that question with any definiteness. The diseased meat was killed and sold, but I am unable to give any data as to the results. We had people sick with various diseases which might have been caused by eating this meat; but whether it did result from this or not, it is impossible for me to say, because I had no way of arriving at a definite conclusion.

Dr. W. M. Smith, of New York.—It seems to me very proper that this association should formulate some recommendation on this matter. It is the office, in part, of this association to formulate recommendations to boards of health that they take cognizance of this disease, and recommend, if you please, a law to the respective legislatures. Legislative bodies of the present time are paying very considerable respect to the recommendations of state boards of health, and they should be asked to take this matter into consideration, and make a law which will prevent the consumption of this food. That would operate better than leaving the matter to municipal bodies. It seems to me before this body separates they should take some such practical action in regard to this subject.

Dr. Quimby, of New Jersey.—I should like to ask the author who read the paper, whether, in the cases which were examined, the sanitary surrounding of the animal examined was taken into consideration. In the cases where the disease has been active, I would like to know the sanitary surroundings of the hog.

Dr. Salmon.—I would say that in some cases the sanitary condition seemed to be very bad, and in others it seemed to be perfect. We find the disease is just as virulent at our experimental station, where we try to be clean, as at places where the sanitary condition is not good. My conclusion has been, after a study of this qustion for seven years, that the sanitary conditions do not have a very great effect on the progress of the disease.

There is one point I would like to speak of again,—that is, its relation to human health. I do not think that the disease of swine plague can be transmitted to people. It has been investigated by a great number of people who have been exposed to the virus in all kinds of ways, and I have made many post-mortem examinations myself when I had wounds on my hands, and when, if there was such a thing as being infected, I should have been infected; but I have never felt any dangerous results whatever, and that has been the experience of all others who have investigated the disease. The danger, it seems to me, arising from it is, rather, from complications. We know that in contagious fevers of all kinds there are formed chemical substances the exact nature of which has not yet been determined; and they seem to vary a great deal among themselves. Now we have never been able to find out, up to this time, whether or not in the cooking of the meat the injurious matter escapes, or whether it still remains in the flesh; but it seems to me that perhaps some of the obscure diseases met with in daily practice, and to which it is almost impossible to assign any cause, may be produced by eating flesh of this kind. I think the experience of almost all health boards would bear me out in saying that the flesh of feverish animals is likely to produce disorders of the digestive track which are very difficult to treat, and which cause a great deal of mortality at certain seasons of the year. It is rather to this class of diseases that I desire to call the attention of the association; and it seems to me the best way of combating this dan-

ger is for the local boards of health to call attention to the matter, and to do all they can to prevent the killing and packing of hogs which are in any stage of disease.

We hope, this winter, to get additional power for the Bureau of Animal Industry, which will enable us to do something towards checking this disease and limiting the amount of it in the country. We shall do all we can in this direction, and must rely on the local boards of health to protect the people.

Dr. Quimby.—Have you discovered the origin or cause of this disease, or supposed cause? You say you think the sanitary surroundings have little to do with it.

Dr. Salmon.—I think it is a disease which arises only from contagion from other animals which have been infected,—just as small-pox arises from contagion with the persons affected with it.

Dr. Quimby.—But where is the origin?

Dr. Salmon.—Where is the origin of small-pox? (Laughter.)

Dr. Horsch, of New Hampshire.—Regarding diseased animal food, I will relate some experiences which occurred in my practice. One was that of an old gentleman seventy-two years old who suffered from scrofulosis. Up to that time there had been no sign of scrofula. I could not ascertain any hereditary cause. But I found that an ox was brought into our city (Dover, N. H.) with what is termed woolf, and my patient had been eating some of the meat. Some time after, he had swelling of the cervical glands. He died two years afterwards. Another case occurred a year ago. On Thanksgiving, 1884, a farmer brought us a fat, healthy looking turkey. When my wife examined the liver, she found all through its tissue white patches, which upon examination had the appearance of groups of tubercles.

I hope that the American Public Health Association will advise some legislative measures to prevent the bringing in of diseased animal food, in the same way as is done in European countries, where the animals are inspected by competent physicians before they are butchered, and also afterwards. I have no doubt many diseases are hunted for in some other direction, which probably could be traced to this cause. I would also like to ask Dr. Salmon regarding Pasteur's experiments. What does he claim for his virus? I visited him a year ago, but had no conversation regarding this point. Does he claim good results from this inoculation, and how much did he use in those cases which died?

Dr. Salmon.—We used in the first instance twice as much as Pasteur advised; that is, we gave five drops to each. In one case we gave as much as a drachm. The one which received the drachm was not affected, and one that received five drops died. For the second vaccination, we used two and a half drops—the amount Pasteur recommends.

Dr. Germer, of Pennsylvania.—I think the sanitary condition has a good deal to do with the matter. Where they keep hogs in a good condition in our country they generally save them, and where they do not, they lose them. I know a fellow who feeds fish and mouldy corn to his

hogs. I know of hardly a glue-factory man in the East who can keep any pigs, although once in a while they will get them through: generally they lose them.

About inspecting the meat: I have seen some of it that you could not sell except to a blind man. Nobody would buy it unless he was dead drunk, or the meat was tied in a sack and he could not see it. But some meat you cannot tell anything about. You cannot tell with the naked eye whether it is infected or not.

Dr. Salmon.—I would like to ask if he thinks children can be kept in so good a sanitary condition that they will not take measles?

Dr. Germer.—If you kept them away from all other children they would not. [Laughter.] There is an island in the Orkneys where it is shown that there were no cases of measles or scarlet fever until some sailors landed and infected the people.

Dr. Salmon.—That is my point. If children are not exposed to measles, they will not take it. If hogs are not exposed to the cholera, they will not take it.

Dr. Bryce, of Ontario.—This matter has interested me very much. I refer especially to the suggestion of Dr. Smith, of New York, that legislation on the subject be urged by this association in order that hogs may be inspected, and that whenever an epidemic breaks out, some more stringent measures be adopted than exist at present. I speak feelingly on the subject, Mr. President, from the fact that while it is true that Canada is at present under an accusation for having brought small-pox into certain parts of the Union, the United States is under accusation for having transmitted to the Province of Ontario an epidemic of hog cholera during the passed season. The history of it apparently is, that hogs sick with the disease were carried down the St. Clair river and washed up on the shores of one of our counties; and in the county of Essex the disease spread some five months ago so largely that the Provincial government, and along with it the Dominion government, took extended precautions, under their epidemic act regarding animal diseases, to limit the disease. If my recollection serves me right, 150,000 hogs have either died from the disease, or have been slaughtered. It seems to me a peculiarly appropriate subject for this association to discuss, as Dr. Salmon has discussed it; and further, that some method for both isolation and prevention be urged upon the legislatures of this country, and the same legislation, I am sure, will be carried out so far as possible in Canada. I am glad to express my thanks for Dr. Salmon's paper on the subject.

Dr. Cox, of Missouri.—This is certainly an important question. It shows, I think, too, the importance of each town and village having one central market. For instance, in my town of 15,000 inhabitants, we certainly could have one general market where all the meat could be inspected; and it is our own fault that we do not have it. They bring diseased meats to our markets, and diseased fowls. For instance, when the chickens had the cholera, you could tell sometimes that they were diseased, for the fowls did not look well; the comb is rather pale, and

has not that healthy appearance that a well chicken has. But frequently it is hard to tell. I have bought them myself, and they have died before cooking next day. And people will swindle us this way unless we adopt severer laws for the punishment of these misdemeanors. We then would certainly be dealt more honestly with by producers.

Dr. Kennedy, of Iowa.—This question is one of a great deal of interest in Iowa. We are ceasing largely to be an agricultural state, except in raising corn to feed to stock. At the meeting of the state board of health of my state, we had our state veterinary surgeon before us, and this question was discussed quite fully; and I think, from his remarks, and from the remarks of Dr. Salmon to-day, that while scientific investigations may seem to agree, the methods for prevention of the extension of this disease are not yet known.

Now, as to the sanitary condition surrounding the animals, I wish to state this: Within perhaps three months, at our State Agricultural College, where Prof. Stalker resides, under his personal supervision, with the best sanitary conditions that could be thought of, the disease broke out, and over two hundred hogs died. It occurred in a virulent form. I think that not more than twelve or fifteen hogs survived. It appeared probable that the disease was propagated there by some hogs—some dead hogs—that were washed there. We asked Prof. Stalker the question why it was that these dead hogs, gathered up from one place and another in order to be rendered out—why it was that the disease was not propagated from them. There are a number of places in the state of Iowa where these hogs are gathered up and placed to be rendered; and hogs run in these lots, they root among them and around about them. They would eat of the decayed carcasses, and yet were exempt from the disease. One of the means of preventing the spread of the disease, and a very popular one, is the cremation, or partial cremation, of these dead hogs, and the feeding of the products to the living. That has been done quite extensively in a good many parts of our state, with, the parties say, very excellent results.

I just wanted to give the facts that Prof. Stalker admitted. He admitted the statement in regard to live hogs' eating the remains of these dead ones and not having the disease. He admitted this was a fact; that he had seen it, and knew of it, but could not account for it.

It seemed to us that we needed some light on this subject. We instructed Prof. Stalker to prepare a circular to be issued among our people, because this disease is very prevalent in our state. I do not say it to depreciate our commercial interests, but it is a fact. We instructed Dr. Stalker to prepare a circular setting forth the causes of the disease, and to what extent it was influenced by food and sanitary conditions, and the means of propagation, so that we might distribute it among the people. He is now engaged on the matter.

Dr. W. M. Smith, of New York.—I would like to understand the gentleman, whether he means that the remains of these infected animals were consumed by the well hogs after they were rendered, or before they were rendered, in part.

Dr. KENNEDY.—Before they were rendered—as they are hauled and piled up in great establishments. The live hogs were in the yards running among them.

Dr. SMITH.—We can see that the remains might be fed to them without any harm: the heat would act as a disinfectant.

Dr. SALMON.—I think I can throw a little light on that subject. We have made the experiment of feeding hogs with the products of sick hogs; and where these were fed to susceptible hogs the disease was almost invariably produced. Of course where an outbreak occurs the susceptible hogs die, and then you have left those that are not susceptible to the disease. If they had been susceptible, they would have taken it before; but not being susceptible, they consumed the products of diseased hogs with impunity. We know that to be true from our experiments.

Last week we fed two pigs with parts of a hog that had just died with this disease, and both are now dead from a most virulent attack of the disease. They had not been exposed before. They were bought for experimental purposes. We have had that result over and over again.

A MEMBER.—You believe, then, it follows the general law of disease.

Dr. SALMON.—Yes; in other words, it is the survival of the strongest.

Dr. JENNER, of Michigan. There are two or three questions which I should like to ask the veterinary professor on the platform, and one of them is very, very pertinent. In the first place, I would ask if two and a half drachms of vaccination virus, so-called, produced all these terrible results, how is it that one drachm did nothing, and how did the hog get rid of that drachm,—how did it get out? That is one thing I should like to have answered.

The next question is, What sort of disease is this so-called hog cholera? Is it one that affects them as a class, or is it a disease which can affect any other kind of domestic animal? Then, again, how is it possible to distinguish whether a hog has got this cholera, or whether he has not; and again, whether it is possible that any one else other than an expert can tell whether these hogs are liable to get it; and then, again, if that is the case, that this is a hog disease, and it is not liable to be propagated to other animals, yet may not human beings get it, as some doctor said? I want to know where it is and how it is propagated. I want to know, if the washing down of hogs in the water that was drunk by the other hogs infected them, why the horses did not catch it, or anybody else become infected with it, subjected to the same influence.

I think this matter is one that has not at all been carefully investigated.

There are a lot of superficial facts and recommendations appended requesting this association to speak to boards of health to have laws passed, and all that sort of thing—for what? I want to know what for. If Dr. Salmon can answer, I should like to know. The whole thing revolves just here: These hogs died. They might have died anyhow. Some people do the same thing. I think it is the exemplification of the general law, the survival of the fittest. I think a great deal of this is stuff.

I think, so far from advancing medical science, it retrogrades it. I think, instead of studying how to save human life, and how to prevent disease, these people are trying to get microscopes down to a fine point. They see all sorts of things, sometimes alive in the water, and sometimes in the air,—but what are they anyhow?

Dr. Horsch.—The gentleman is a member of the American Public Health Association, and he ought to be able to answer a great many of these questions himself. In regard to vaccination, it is certainly known that sometimes it does not take. It may be the fault of the virus. It is just so here. The virus may not take effect, and yet we certainly would not say that vaccination is of no account because of its failure sometimes to act.

Dr. Jenner.— I think that there is just as much difference between the vaccination for the prevention of small-pox and the vaccination of hogs as there is between chalk and cheese;—one is a thing which you can prove, and is the result of a regular scientific series of cause and effect; in the other case, it is a perfectly uncertain affair altogether, in a state of embryo, so to speak. I think I know something of vaccination. My name would lead you to believe that I knew something of that. But I think that there is as much difference between these two as there is between chalk and cheese, or light and darkness.

Dr. Reed.—I would offer the following resolution:

Resolved, That this association urges the immediate legislation, national, state, and municipal, for the protection of our citizens from the use of diseased meats by proper legalized authority. (Referred to Executive Committee.)

Dr. Quimby.—While I do not differ from the reader of the able paper in much that he has said, I do not think it ought to go out from this association, or from any association, that it makes but little difference so far as the sanitary surroundings of the hog are concerned. I believe it makes a difference so far as the sanitary surroundings are concerned of everything in regard to the germination of disease,—cholera, scarlet fever, diphtheria, or anything else. If we admit now for a single instant that it makes no difference about sanitary surroundings, what becomes of the zymotic diseases that are considered diseases of filth, preventable diseases? I think that it is a mistake. I know hogs can digest almost anything, but from an instance which came under my observation I know that the disease was set up by what had been eaten.

Dr. Salmon.—We have not yet had time to work up the effect of what is eaten by the hog.

I would like to say one word about the paper I read. I think if you will examine that paper you will find there were in it facts in regard to the investigation we have made,—only the actual facts which have been determined. That the disease can be communicated to swine by a particular germ we have demonstrated beyond any question; and it seems to me too late in the day for any gentleman of the American Public Health Association to demand that we fight over again the principles on

which the germ theory of disease is founded. It seems to me that it has been settled in the minds of scientific men, not only in this country, but in Europe, and by those who have given their lives to this study, that certain diseases, thoroughly investigated and placed on a scientific basis, are caused by certain micro-organisms, and that it is absolutely impossible to contest that fact at this time with anything in the shape of facts.

Now I have not claimed anything. I have not asked that this association should put itself on record in regard to anything whatever, except that they recommend,—and I do not ask this in my paper, but I do ask it now,—that this association recommend that the local boards of health should exercise particular care in regard to hogs which are killed for packing and consumption, which may have been exposed to this disease; and now, when every hog-yard in the country—in Chicago, Cincinnati, Pittsburgh—is probably infected with the disease, it seems to me very important that the local boards of health should exercise particular care in regard to the killing of hogs which are in the first stages of this disease, or any other stage. I think the association can recommend this without assuming anything which it is not eminently proper it should assume.

Dr. Raymond, of New York.—Some gentleman has asked whether this association will be acting wisely in promulgating the view that sanitary conditions were not largely concerned in the propagation of a disease. I think, sir, this association can little afford to promulgate any views not sustained by the facts. If there is one point settled in the discussion which has occurred here to-day, it is that hog cholera is not a disease that is produced by unsanitary conditions. The fact that it is developed in the experimental stations of our own government and of Iowa, both of which institutions we have reason to believe have perfect sanitary conditions, and that it has existed there not merely as an epidemic, but as an epidemic of a most virulent form, is to my mind conclusive that it is due to specific organism.

In this argument, made here this morning in reference to cholera, I hope we shall not overlook other diseases of animals. While hog cholera is undoubtedly injurious to animals, as Dr. Salmon has said, it has never been proved that it has been propagated to human beings or contracted by them. We have, on the other hand, a number of diseases which are contracted by human beings from animals. I trust we shall not forget that most important of all diseases, tuberculosis of cattle; and this association can do no better work than make a recommendation on the subject in this connection to boards of health or inspectors, recommending, not that they simply inspect in a superficial manner, and go through slaughter-houses inspecting meat after the carcasses are prepared for inspection, but that they inspect it before it is prepared. Thousands of carcasses pass into the market in this way, when they would have been rejected had they been inspected by the officer beforehand. No man can pass intelligently on the carcass simply from its appearance, except in rare cases. Thousands of carcasses of animals, which have died from pleuro-pneumonia and other diseases, have been passed by inspectors who have given their

attention only to the carcass itself. Sir, the time has come when this association must recognize the advantages which have come to it by an introduction of new blood. The medical profession has been largely benefited by the work done by veterinary surgeons; and in my judgment no board of health is established on a proper basis unless it has upon its staff a competent, educated veterinarian, whose duty it shall be to inspect animals in the process of being slaughtered, when the viscera can be examined, and their disease thus be detected.

Dr. JAMES, of Pennsylvania.—I would like to bring out one point. Perhaps Dr. Salmon can bring it out. In certain localities and at certain times, with cholera prevailing, it is also known that the chicken cholera seems to run along in a close circuit with it. I would like to know to what extent it is taken up by chickens feeding upon the remains from the poisoned animals; how far the disease is carried to these chickens, and carried off in hog cholera or in any other disease. Has that point been brought out by the investigation?

Dr. SALMON.—We have a number of experiments in progress from which we hope to determine that point. So far it has not been worked up with any satisfaction. We are unable to say whether the virus of fowl cholera affects the hog or not. We hope to work it up, and see whether there is any connection between the two diseases.

Dr. KENNEDY.—I would like to say, that while we are having quite an epidemic of hog cholera, from the reports coming to the secretary's office I think there has been no time in the history of our state when we have been as free from chicken cholera as we are now.

Dr. BAKER, of Michigan.—On the other hand, a few years ago, in Michigan, we were investigating hog cholera, and I found almost uniformly on those farms where the animals were dying with hog cholera chickens were lying dead all over the premises.

Dr. GERMER.—They kept the chickens in the pig-stye. No wonder.

Hon. ERASTUS BROOKS, of New York.—This is a commercial question, as well as a question of health. What Dr. Raymond has said in regard to cattle is essentially important, quite as important as what has been said in regard to cholera of hogs.

Now those of us who take an interest in public affairs abroad as well as affairs at home realize how much this country has suffered within the few years past from a resistance on the part of the German government, and especially on the part of the German minister there, Bismarck, who is practically more the government than the emperor himself, to the sending of cattle and hogs to Europe from our own country, and that the remonstrance has been placed upon the ground of the effect on the health of the people. First this remonstrance came from France, and then from Germany, in regard to the export of cattle in an improper condition, either in regard to the animals themselves before they were killed, or in regard to the manner of packing them. This resistance has attracted the attention of our own government, and become a subject of great commercial importance to the farmers and to the producers, and to the country at large.

It therefore seems to me an eminently proper thing for the American Public Health Association to do, interested as it is in everything which belongs to health and other interests incident to health, to take some such practical notice as is proposed in regard to the question before us. I therefore most heartily second any motion made to further investigate and report on this subject.

Dr. Verdi, of District of Columbia.—The matter of diseased animals in Europe is indeed a question of great importance; but I only want to remark that we need not be alarmed by the action of any European power in regard to the condition of our animals. The assumption that our animals arrive there in a diseased condition is only an excuse, and it is done, as is well known throughout Europe, to prevent the American food from entering European countries. It is a serious question now in the whole of Europe, and particularly in France and Italy, whether America shall feed the people, or whether they shall feed their own people. A time will be reached when American producers will put their productions in those markets cheaper than they can. Therefore these measures were taken to prevent the introduction of American food in Europe, and the question of disease has simply been an excuse. I have thorough knowledge on the subject from conversations with diplomats and persons who are well acquainted with the manner in which such rules are passed in the parliaments of Italy, France, and other countries.

Mr. Brooks.—While what my friend says is true, it is not the whole truth. In regard to this question of sending cattle and hogs abroad, I know, from evidence as clear as one can get evidence, that the pork sent abroad, from improper packing, rendering it an improper food for use at the time of its arrival in France, was the cause, or the alleged cause, of the prohibition which was made by order of the French government. Every man here will concur that it is the most desirable thing in the world to do well what you undertake to do at all; and this prohibition has led to the correction of the error, in the more correct packing of the food which has been sent abroad. I have no doubt my friend is true in regard to the general aspect; but imposing high tariffs as we do in this country on nearly everything we import, imposing a tax duty on three thousand articles where there are hardly a dozen in England and elsewhere, leads to retaliation; and that spirit of retaliation no doubt has afforded an excuse for the prohibition ordered by the German government more recently, and previously by the government of France. I think that when we do send food abroad, it should be sent abroad in a healthful condition.

The President.—If you will indulge the chair just one moment on this subject, he would like to say that there are many diseases in this country which are called hog cholera, which are just as unlike as small-pox and measles, but it is all called hog cholera. You will recollect another thing, that it was a long time before it was known that there were two fevers, one of which was called typhoid, and the other typhus.

You will remember that if Klein is as honest as he is capable, we must conclude that the hog cholera we know in this country, investigated by our distinguished friend, Dr. Salmon, and the specific contagion of which he claims to be micrococcus, and the specific germ cultivated and known as Klein's bacillus, are two different things, and both cannot be right. There must, therefore, I say, be some doubt as to the two diseases. I am inclined to think that the two diseases are different; that the hog cholera known in this country is not the hog cholera cultivated by Klein.

Mr. Smith, of New York.—Is there not a resolution pending?

The President.—Yes, but it was referred to the Executive Committee without any further motion.

Dr. Fisher, of Rhode Island.—I think there is no kind of reading that is less interesting to an audience than statistical tables; and I certainly do not feel disposed at this time to impose upon this audience any such unsatisfactory proceedings. I had not promised a paper to be read. I simply promised to give statistics of consumption in Rhode Island for twenty-five years, and they are embodied in the tables I shall present. I shall be happy to furnish reporters with some general conclusions; but to endeavor to read those tables at this time, and especially at this late hour, would, I think, be a mistake. There is one table or diagram which was quite easy to prepare, which shows the proportion of consumption to other diseases during a period of twenty-five years; and with the presentation of that, and such comments as the reporters may feel disposed to make use of, I think will be all that I need give at this time.

On motion, the paper took the usual course of reference.

The President then filled the vacancies in the advisory council.

The President.—There are several vacancies yet, but there are no representatives from the states to fill them. There will be a meeting of the advisory council at 4 o'clock in the ante-room of this hall. There will also be a photographer present to-morrow before ten o'clock to take the photograph of the association, and those who want their good looks to appear in the group should be promptly on hand. There will also be a meeting of the Executive Committee at the room of the secretary this afternoon at 3:30 o'clock. By reason of the adoption of the amendment to the constitution all of the ex-presidents are members, and are invited to be present.

The Special Committee on the Essays on School Hygiene will meet this afternoon at room 5, at 5 o'clock.

Dr. Kedzie, of Michigan.—As I am *ex-officio* a member of the Executive Committee, which will meet at the same time practically as advisory council, I ask that my name be taken from the latter committee, and Dr. Wight placed in my stead.

Then, on motion, the association took a recess until 8 o'clock P. M.

EVENING SESSION.—8 O'CLOCK.

The hour of 8 o'clock having arrived, the time to which the association had taken a recess, the President called the meeting to order.

The PRESIDENT.—Ladies and Gentlemen: I have the honor of introducing to you Dr. J. M. Toner, chairman of the Committee on Reception, and a member of the medical profession of the city of Washington.

Dr. TONER.—The Committee of Reception had expected that the president might honor us with his presence this evening, but the duties with which he is now pressed made it necessary for him to decline. He has, however, sent us a very pleasant and able letter, which I will ask the Secretary now to read. (See page 30.)

The reading of the president's letter was greeted with applause.

Dr. TONER.—I have the honor of suggesting the name of President Grover Cleveland for election as the first honorary member of this association, and move that a rising vote be taken.

The question was put, and President Cleveland was elected by acclamation first honorary member of the American Public Health Association

Dr. Toner then delivered an address of welcome. (See page 27.)

The PRESIDENT.—I now have the honor of introducing to you the president of the Board of Commissioners of the District of Columbia, Hon. J. B. Edmonds. (See page 25.)

Dr. TONER.—The next name on the programme is that of Senator Harris. His duties in committee have kept him away from our meeting. I am not aware that Mr. Beach, who was expected to be present, is on the platform, but in the absence of Mr. Beach I would call on Mr. Townshend, a member of the house, who is present, and I trust he will make some remarks.

A MEMBER.—Mr. Townshend is modest, and begs to be excused. (Laughter.)

Mr. TOWNSHEND.—Mr. President and Gentlemen: It is not on the score of modesty that I decline to address this intelligent and scientific audience, but it is because I have nothing to say. (Laughter.) It is a subject with which I am entirely unacquainted, and if I were to attempt to make an address I should disappoint all my friends and gratify all my enemies. (Laughter.) I came here to-night under a positive pledge that I should not be called upon to make a speech, and therefore I am wholly unprepared.

I have been so delighted with the excellent address—with the edifying and elegant address—of my friend, Judge Edmonds, that I must beg you to accept it as a substitute for anything that it is in my power to say, even if I had weeks and months of preparation. (Applause.)

Dr. TONER.—The next business in order will be the annual address of the President (which was then read). (See page 1.)

At the end of the President's address, which was received with applause, Dr. Toner announced that the programme for the evening had been finished.

Dr. QUIMBY.—I would like to offer a resolution in the spirit of the able address of the President:

WHEREAS, The germ theory of disease has now become so well established in this country, and, in fact, throughout the civilized world, that any investigation carried on in reference to the cause of epidemics without this germ theory as a prime factor would be considered imperfect and unsatisfactory; and

WHEREAS, We are far behind many nations, especially France, Germany, and England, in national or governmental investigation of these micro-organisms;

Therefore, be it resolved, That it is the sense of this meeting, that, in accordance with and in the spirit of the President's very able address, a special committee of seven be appointed by the President of this association to draw up a bill, and present and urge the passage of the same by congress, for the establishment of a National Bureau of Microscopical Investigation, and that the sum of $25,000 be annually appropriated by the national government for the purpose of carrying on this great and important work in the advancement of science.

The PRESIDENT (Mr. Brooks in the chair).—Under the rules and regulations of the association, resolutions of this kind must be referred for final action to the Executive Committee, and the Executive Committee will, if they approve it, report it back to the association with their recommendation. Without further motion, the resolutions will take that reference.

The association then, at 10:30 o'clock, adjourned until Wednesday, December 9, at 9:30 A.M.

SECOND DAY.

WEDNESDAY, December 9, 1885.

MORNING SESSION.—10 O'CLOCK.

The hour of 10 o'clock having arrived, the association was called to order by the President.

The PRESIDENT.—The photographer is present, and will take the picture of the association in a body in a few minutes.

The first thing in order will be the announcement of the Committee of Arrangements.

The CHAIRMAN OF THE COMMITTEE.—I will state that the Committee of Arrangements have no further announcement at present.

The PRESIDENT.—The next thing in order is the announcement from the Executive Committee.

The SECRETARY.—The Executive Committee recommend the following names for membership. (Names in list.)

On motion, the Secretary cast the ballot of the association for the names as read, and the persons whose names were read were admitted as members of the association.

The SECRETARY.—The "Cosmos Club" has extended an invitation to all the members of the association to visit its rooms.

The Executive Committee then reported on the resolution introduced yesterday in relation to the recommendation for legislation concerning

diseased meats, offered by Dr. Reed, to the effect that it is inexpedient to recommend it.

The Executive Committee requested that the Secretary be authorized to make some verbal changes in the amendments adopted yesterday to the constitution.

On motion, the request of the Executive Committee through the Secretary was granted, and the changes authorized.

[The association here adjourned for a period of ten minutes, in order that the photographer might take a group picture of the association as they stood on the front steps of the hall.]

The PRESIDENT.—The next thing in order is the report of the Committee on Disinfectants.

The chairman of the Committee on Disinfectants not being present, the President proceeded with the regular order.

The PRESIDENT.—The next thing in order is the paper on "Small-pox in Canada, and the Methods of Dealing with it in the Provinces."

Dr. Bryce, the author of the paper on small-pox, not being present,—

Dr. WATSON said—I will read the amendments which the Executive Committee propose to the constitution which was adopted yesterday.

The proposed amendments, which were previously adopted, and permission to alter which had previously been given to the Secretary, were here read.

Dr. Bryce entered the hall, and read the paper on "Small-pox in Canada, and the Methods of Dealing with it in the Provinces." (See page 166.)

The PRESIDENT.—Are there any remarks to be made on the paper just read? There is here another gentleman from Canada who must be familiar with the subject.

Dr. HINGSTON, President of the Central Board of Health of the Province of Quebec.—I have a statement to make which perhaps could be better made at the end of the session, when you are about to disperse; but I must make it now, and I hope the more timid will not be unnecessarily alarmed. I am from Montreal. (Laughter.) I can say so here with some degree of security, but on leaving our city I was a little afraid to register my name at the hotels as from Montreal, and I was relieved when I arrived in this city that I could register as from New York. When I go back to New York it is not improbable that I shall register myself as from Washington. (Laughter.)

Dr. Bryce has given you a long report of the epidemic in Canada. It is very exhaustive, but I could not help thinking that it was chiefly from an Ontarian point of view. Montreal, as you know, has lately been afflicted as perhaps no other city on this side of the Atlantic; but I may also say that never did a city make such tremendous efforts to get rid of an epidemic as did Montreal. Bear in mind that small-pox did not originate there. It did not "drop as the dew from heaven upon the earth beneath." It came to us from outside our province, and through the province of Ontario. I shall not say whence it came. It was traced

from one place to another, to Michigan, and thence to some state in your Union which has no state board of health. Let us leave it there. If there are any states in the Union which have now no state boards of health, or any municipalities which have no local boards, it will be a good excuse for their creation. (Laughter.) There is no denying, however, that when it did come, a section of the city—its most thickly settled quarter—was unprepared to receive it. Rather let me say, it was prepared to receive it well, and to house it. The soil was well disposed, and it readily germinated. Freedom from small-pox for years had induced negligence, and inattention to vaccination. In Montreal, for several years past, pamphlet after pamphlet had been printed and distributed, and newspaper articles had been written, sowing broadcast anti-vaccination views. Unfortunately, too, the beautiful French language has been chiefly the medium of conveying these views.

But now, gentlemen, you must not imagine from what I state that the adult population of Canada is not a vaccinated population. It is however unfortunately true, that in consequence of the dissemination of these views in regard to the uselessness, nay, hurtfulness, of vaccination, the juvenile population of Lower Canada, at least of Montreal, is not, or rather was not, a vaccinated population at the time of the outbreak. The diatribes against vaccination began ten or twelve years ago, and the largest mortality has been in children under that age whose parents neglected or refrained from vaccination in their behalf. Notwithstanding the severity of the epidemic we have been exposed to, these views are yet being disseminated in pamphlets. That section of the public press, however, which formerly lent its columns to the anti-vaccinationists, has been ashamed to yield them again to that purpose. So, then, after this epidemic began, our first labor was to educate a large section of the people. What added to the difficulty was this: Different portions of the population had to be approached in different ways. A prejudice already existed against public, and an open hostility to obligatory, vaccination. When erysipelas developed after vaccination, or something of the kind, however trivial, happened, the anti-vaccinationists were always ready to ascribe it to the use of bad vaccine virus, and thus a certain class of people became more and more opposed to the practice. That prejudice, however, has well-nigh disappeared; and we are indebted in large measure, I am glad to say, to our own commercial people for this. They early made it a rule that no one should be employed in office, factory, store, or warehouse, without a certificate of vaccination being produced by the employé, and also a certificate from a reliable source of freedom from infection in their homes and houses. Appreciating our efforts to help ourselves gave us the moral support of the American authorities, and I desire thus publicly to thank them for the aid afforded us. Persons who were imbued with these strange, delusive anti-vaccination views, when they reached the frontiers of the United States were politely but firmly told, "You cannot enter our territory unless you show marks of recent vaccination." In that way our hands were strengthened. Indeed,

with that aid more has been accomplished in a few months than otherwise could have been effected in as many years. (Applause.) Ontario took like action with like results. That province was comparatively free from infection, and was as anxious to preserve itself as were the government and people of the United States to protect themselves.

The city of Montreal, gentlemen, did more, I think, in regard to vaccination than has been accomplished by any other city of the same size in the same period of time. This was brought about, in considerable measure, by writing and disseminating pamphlets; by using the public press; and by organizing vaccination bureaus. With details of what opposition was met with I need not detain you.

Montreal is peculiarly situated. It is a city, as you know, of something like 180,000 inhabitants. But it has a large outlying population, and this population would not come into line. At one time the disease was completely under the control of the civic board, but the outlying municipalities sent it back again. The government of Quebec, finding that the city of Montreal could not deal with the suburban districts, created a provincial board of health, and endowed it with arbitrary powers.

Legislation had to be created when the epidemic was at its height. The rules and regulations prepared by the board were sent by special messenger to the seat of government, one hundred and eighty miles distant, and within forty-eight hours became law. If there was any want of diligence, it was certainly not with the government.

Vaccination has now been carried out on a very large scale, and isolation, which was found to be difficult, is now tolerably complete. Here I would say to you, gentlemen, representing boards of health all over this vast continent: Have in every city of magnitude a building, properly constructed and properly furnished, at least in part set apart for an emergency, into which at a moment's notice, even at midnight, you can by turning a key admit a small-pox patient, or a person suffering from any other infectious disease, to an asylum which he has a right to expect in every Christian community.

What was our position in Montreal in the beginning of March last? I go back two months further than Dr. Bryce. There was not a place prepared for isolation. We had, as I have already said, been free from small-pox for several years. That immunity had begotten, as it has often begotten elsewhere, a fatal inattention to preparation on the part of the citizens. At the beginning of the epidemic there was no building in which a person could be placed who was suffering from small-pox; and that too in a community rendered peculiarly susceptible to small-pox by neglect of vaccination.

It was found to be no easy matter, even when the hospital was ready and thoroughly appointed, to get persons to leave their houses and enter it. Even the poorest elected to nurse the disease at home. In some cases it was necessary for the chairman of the local board of health, and even the mayor, followed by the police, to remove them. Indeed, in the minds of some lawyers and some judges of our courts it was the impres-

sion that the law had been strained by the authorities. But the people were prepared to go even beyond the law in order that needful sanitary regulations might be enforced. (Applause.)

At first there was only one building, but it was not crowded until the masses had learned to appreciate the advantages it afforded. What did Montreal do then? It took the largest, one of the handsomest, the most airy, and the best suited building in the neighborhood of the town, which for many years had served the purpose of an exhibition building. There complete isolation was obtained. Those of you who have visited Montreal know how admirably situated those exposition buildings are. But the municipalities outside of the city (and I could understand their opposition) did all in their power to keep us from going there. They did not want us,—nobody wanted us; but we took possession, were lodged there, and at the present moment I think that isolation is as complete as it can be.

Then, again, objection was made to placarding infected houses. Sometimes persons were maltreated in putting up these placards, and at first no sooner were they put up than some one tore them down. But by perseverance the city authorities finally succeeded; and now when a placard goes up it stays up, until it is taken down by order of the authorities.

The same also with disinfection. This has been carried on in accordance with the most recent views on sanitary science. I was glad to see the pamphlet on disinfectants in the outer room. I may say that I took several of them, although perhaps only entitled to one. The views there set forth are much the same as those carried out in the city of Montreal.

Another difficulty. Small-pox was amongst a large section of the poorer population. Means had to be provided for their support. A thoughtless man, and one who looks at the matter from a sanitary point of view only, is apt to act selfishly. He puts a placard on the door, and leaves the place. Yet if this alone is done, the baker, the butcher, the grocer, the milkman, will be afraid to go to that house, as if the articles delivered by them to others were likely to carry contamination with them. So we had to go to work and support those families, and many hundreds were maintained by the city, and I must say ungrudgingly. The duty was done cheerfully, not only by the municipal authorities, but by a large number of citizens. Able and intelligent private citizens coöperated with them.

The provincial board of health had its work. It had, at first, to draft rules and regulations concerning every health question. When completed, it was found by wise lawyers, and lawyers are always wise, that certain little links were wanting; and we had to supply them in both the French and English languages by repealing them and substituting others. We had to lay down rules for isolation and vaccination for the entire province, many parts of which required special attention. We had also to enlist the clergy and members of the medical profession, and we thus accomplished, I think, by educating and persuading, what we could not

have done by threatening. We had to find out how we could influence Mr. A., Father B., or the Rev. Mr. C. In various ways we got in a short time boards of health almost over the entire province of Quebec; and these are in harmony with the central board. I should perhaps say, gentlemen, that there are difficulties arising from a mixed population, which, while it may have its advantages, has also sometimes its special disadvantages. An Englishman and a Frenchman may speak each other's language, but they may not or do not always speak the language of each other's thoughts. It is only those who associate much together, and who speak both languages, and who are known to sympathize with each other, who can accomplish anything with each other. One who can speak another's language, but who has no regard for that other's nationality, is quickly appraised by the latter, who has no regard for the former in return; and I do not blame either under the circumstances. (Laughter.) The same may be said on a reversal of the positions. When it is the Englishman's appreciation of the Frenchman, or the Frenchman's appreciation of the Englishman, that is in question, the national susceptibilities of the individuals composing those two races were not always recognized as they should have been; and in conversations, and also in a section of the press,—French and English,—the disease was unthinkingly called "French" by the English speaking, and the remedy (vaccination) was described by the French individual as an attempt at English domination. The mischievous tendency of this foolish race distinction you can well imagine.

We were assisted by the railroads. They coöperated with the provincial board, and sometimes at some sacrifice. When it was pointed out to them that at particular places on the line of road small-pox prevailed, and the local authorities refused to act, the order went forth to pass that place. The service was not interrupted twenty-four hours before that municipality was upon its knees asking for relief. (Applause.) Without the coöperation of railroad companies the authorities never could have done what they did.

We also obtained valuable assistance from the minister of education. I give you these details because, although I hope most fervently none of you will be in the same position, some of you may yet be placed there, and these details may not then be uninteresting. We had sent instructions to the schools and colleges of the province to receive no person without a certificate of freedom from infection in their houses, and freedom from disease in their persons. The schools, colleges, and seminaries of learning coöperated with us very cheerfully. We had but few institutions that did not yield quickly, but they too were glad to give way rather than incur public censure. And the public was at the time quite disposed to be censorious. (Applause.)

The provincial government of Quebec coöperated with us in legislation. It did more: it readily sanctioned necessary expenditure. Gentlemen, you know the province of Quebec is not a wealthy province, yet it pays its debts honestly, I believe. But when we applied for money, within a short time the cheque was forwarded to us.

Shortly after the board was formed, we passed a regulation having full legal force, making vaccination obligatory. (Applause.) We instructed the boards of health throughout the province how to vaccinate; but, gentlemen, enforced vaccination, to be successful, must depend on a system of public registration of births. We have no law for compulsory registration of births outside of baptismal registration, as they have in many European countries; yet anything like a complete system of vaccination must depend upon an equally complete system of birth registration.

I will now allude to the death-rate from small-pox. It has been stated by Dr. Bryce to be about 3,000 persons in a population of 180,000. His figures are correct. The figures, however, according to months, and their rise and fall, may interest you. The death-rate in April was 6; in May, 10; in June, 13; in July, 46; in August, 239; in September, 660; in October, 1,391, when it suddenly dropped to one half, or from 1,391 to 633, and from 633 again to 300. I telegraphed to Mr. Gray, chairman of the local board, to ascertain the last mortality returns, and find it still decreasing rapidly from day to day.

Now, gentlemen, the larger figures certainly show an enormous death-rate. I dare say it will occur to you that 3,000 deaths among children represent 3,000 houses in mourning. Not so, I am glad to say. I am told that in certain states in the Union there is not an average of one child under ten years of age to a house, and that in one or two states it requires two or three houses to produce one child (laughter), and that therefore 3,000 children might possibly represent 6,000 or more houses. The death-rate in the province of Quebec is large, but I am happy to say our birth-rate is simply enormous. (Renewed laughter.) We have lost largely from among the children, but we had an abundance, and an abundance still remains. No country in Europe, no country anywhere, can give such a birth-rate as the province to which I belong. (Laughter and applause.) I am glad, gentlemen, that you approve of that. (Renewed laughter and applause.)

The members of the medical profession have never sounded an uncertain note on that vital question, though the ear may not hear it, or, hearing, may not always heed it.

As an instance of that natural increase, I may, though not germane to the subject before the meeting, state that a hundred years ago the population was 70,000; but after Canada was ceded to the British it is estimated that 10,000 returned to France. From this remaining 60,000, without any appreciable addition from abroad, we have in a period of a hundred years, notwithstanding the small-pox occasionally, 1,200,000 in Canada alone; and you in the United States have obtained 500,000 of these sober and industrious people. I wish to correct an error, for it is worse than an error, into which a portion of the press, especially the Eastern press, has fallen in speaking of this matter. They attribute the violence of the disease in a section of Montreal to a want of cleanliness on the part of the French Canadians. Now any one who knows these

people must know that if there is one people cleaner than another, it is the descendants of the French. They are scrupulously clean; but they have large families, and they say they cannot help it. (Laughter.) *C'est le bon Dieu qui les donne*, and they thank God for them. In many houses children are the chief furniture, and the cubic dimensions of the dwellings do not always increase in direct ratio with the number of occupants. When there is a large number in each house, and when small-pox enters it, it may carry off many unvaccinated ones under eight or nine years of age.

The impression abroad, that every death represents a house in mourning, is incorrect. Divide the number of deaths by four or five, and you will have a better appreciation of the number of houses that were afflicted. The disease, moreover, was so confined to certain districts, and so free were others from it, that you might at any time during the epidemic have passed the season at any of our fashionable hotels without seeing more of the disease, or hearing more of it in the principal streets, than you would to-day in Washington. But the cloud, dark as it was over certain sections of our fair city, has broken. It is now drifting rapidly away, and a now well vaccinated people exult at its departure.

Dr. WATSON.—I move you, sir, that in the discussion of every paper to-day the time of each member be restricted to five minutes.

The question was put, and the motion carried.

Dr. SMITH.—I was very much interested in the remarks of the gentleman from Canada, particularly with reference to vaccination. Within a few years past this matter has been brought to my attention in a very unusual degree, and it occurred to me just at this juncture, with the permission of the association, to illustrate, by a comparison not often afforded, the effects of vaccination, compulsory or otherwise. For that purpose will the association, a little out of order perhaps, indulge me for a few minutes in order that I may present this statement?

Permission was granted.

The time allotted for the reading of the paper having expired,—

A MEMBER.—I move Dr. Smith's time be extended sufficiently to allow him to finish the reading of his paper.

Dr. HUNT.—I hope that motion will not be made, especially because this is a paper, and I hope that the rule of the association will be recognized and conformed to in this matter. I am sure the gentleman desires to do this, and I hope there will be no extension of time.

Dr. SMITH.—I was aware that I was a little out of order when I came upon the platform to read what I should have stated upon the floor informally; but I think under the circumstances I will withdraw the further reading of the paper, as it cannot be finished in five minutes. I thank you for the courtesy already extended.

Dr. BELL.—Mr. Chairman and gentlemen, the few words I have to say have been suggested by the gentleman who read the paper from Toronto, and the remarks of the gentleman from Montreal. It is with a view to the lesson that it teaches us. If there is any community in the

world that ought to apply this lesson, it belongs to a good many communities in the United States which are in the same situation relatively as Montreal was before the small-pox appeared among its people; and if one tithe, aye, one hundredth part, of the energy displayed by Montreal since small-pox appeared had been displayed before its appearance, it would have prevented a single case or a single death. (Applause.) I speak energetically on this subject because I have for many years conceived it to be a crime to have the small-pox. When they tell us here that it is a hardship to quarantine a community because it has small-pox, I say it deserves it; we deserve it, if we get the small-pox. If there is anything that should induce us to use every atom of strength we possess, it is that which should force us to vaccinate the community. We should all be vaccinated. Now we talk about compulsory vaccination. It is easy enough now to do it in Montreal, because they have lost some 4,000 lives.

Dr. Hingston.—Three thousand.

Dr. Bell.—How many families are bowed down in mourning at this loss? Now, of course, they are sensitive. That is why they can now be vaccinated.

I have within ten days answered a letter coming from an anti-vaccinationist on the other side of the water;—answered it not to him—he was unworthy of notice. He says they had small-pox in Montreal because it was filthy. Now we are told that it is one of the cleanest cities of the country. I believe it. Who are the anti-vaccinationists? Are we to notice them in any other way than to go on with our work? Put them under our feet, and we can ride over them. Put them in jail. They are infinitesimal: they are small in influence; they are either cranks, or unworthy the notice of sanitarians. (Laughter.)

I fear I might say too much if I were to use any more time in this discussion. One question, however, occurs to me, and I wish to ask what proportion of the community were unvaccinated in Toronto.

Mr. Bryce.—Not more than ten per cent.

Dr. Bell.—I might ask the same question in regard to Montreal, when this small-pox first appeared.

Dr. Hingston.—It has been said they were not a vaccinated people.

Dr. Bell.—I say so too. If I were to ask the same question in regard to the District of Columbia, or south of the District of Columbia, you would find the proportion of unvaccinated running all the way from ten to twenty-five per cent. of the population,—quite enough to give us the same sort of epidemic they have had in Montreal. After an epidemic, of course they can be induced to be vaccinated.

Dr. Hingston.—Yes, of course.

Dr. O'Connor.—Gentlemen, with reference to a remark made by Dr. Hingston in regard to the cleanliness of the French people, I myself desire to bear witness to it. I am cognizant of everything that he has said fully, coming as I do from a city in Massachusetts where people from Montreal mingle with our people. The French Canadians are a

cleanly people. But there is one strong point in the whole of the argument we have heard to-day, namely, the great need and importance of vaccination.

I myself passed through a terrible ordeal in my own city some thirteen years ago with a very alarming epidemic. It was then a young place, and the board of health was entirely unprepared for it. It was a large manufacturing district, and about one third French Canadians who had large families living in districts by themselves, entirely unvaccinated. The result was a very serious epidemic, growing upon us until we had to call upon the authorities, and compulsory vaccination was set on foot. Within three weeks, gentlemen, the epidemic was at an end. (Applause.) The vaccination was so universal, so complete, that it stamped out the disease. To-day, when the travel is so great between our city and Canada, our vaccination has been so thorough and so complete that we have not yet had a single case of small-pox. (Applause.)

This, gentlemen, speaks to you in a language more eloquent than any living man can use, and I am here to bear witness to this great and crying evil of anti-vaccination. It has come up even in my own city. Gentlemen who have been educated in Canada to the profession of medicine have within two weeks proclaimed that there was nothing in vaccination. Shame upon them ; forever shame to such men in this age ! It is not true. They themselves do not believe it. They have been vaccinated, and their families have been vaccinated. (Applause.) Let us hear no more of this anti-vaccination. Crush it down forever. It is a living lie on the face of it. (Applause.)

Dr. Quimby.—I would like to ask the gentleman one question. I would like to know how many cases came to his knowledge of death from small-pox of persons who had been vaccinated?

Dr. O'Connor.—I have no positive knowledge of any. I think there were only two deaths that occurred ; and that would give a percentage of 37 per cent. in cases which had not been vaccinated, and 6 per cent. among those who had been vaccinated.

Dr. Quimby.—The reason I ask the question is, I have known of a few cases of death from small-pox after vaccination, but it was the fault of the vaccine-virus vaccination. Hence it is that a great many of the people get dissatisfied. They say if we get vaccinated it will go for nothing. I hold we ought to be more strict in our vaccination. I hold that you cannot vaccinate properly unless you see the patient about three times. You know how carelessly it is done generally. The patient is called up. His arm is scratched, especially if he is a pauper, and if a sore is made it is called vaccination ; and very probably it is a spurious vaccination, and the person is not properly protected. Where a physician is called to vaccinate a child, and does so, he should see it again in six or seven days, and if the vaccine virus has not taken, the operation should be repeated. When the scab appears he ought to inspect that, and see whether he has a honey-combed pit. The mere form of vaccination is a farce, and it leads oftentimes to great incredulity about

it among the people; and so I say we should be very careful in regard to the manner in which we perform this operation.

Dr. James.—I remember some twelve or fifteen years ago—probably some of the residents of Washington will remember—there was a sweeping epidemic of small-pox. They had it in New York and in the Western cities; and although we had every advantage of experience of former years in regard to vaccination, yet this epidemic went on until it spread, I think, over the entire country. We had cases of persons who had had the small-pox once who took it again. Some of those who had been thoroughly vaccinated only a few years before took the small-pox and died, although their mark was good. I would like to see a compulsory law in every city and community. Not only that, I would like to go further. I would like to go so far as to say that during these epidemics people should be compelled to stay in their own locality. I think, when an epidemic breaks out in a locality in any city, the municipal authorities should keep the people there until they had passed the period of infection, and in this way keep the disease where it is.

Now, Mr. President, if this is done in every country, this law of quarantine, this law of holding people in check, could be exercised so that the people of every country should be responsible for its own inhabitants when they have these epidemics. I think it would be a better system than quarantine against the people who have these diseases.

I am glad to see that Ontario has done this; I had no idea that such measures had been carried out as have been stated to us to-day. They have done a noble work. I was going to suggest to the association that we should start something of that kind in this country, and let it extend to other countries. I am glad that Canada has taken the initiative. I should like to see this association recommend to our congress the same thing, and then Canada and the United States can shake hands on this measure, at least in preventing the spread of small-pox.

Dr. Bell.—I think that the gentleman's logic is bad. I want to ask him whether he would apply the same rule which he wants to have applied in cases of epidemic to a house on fire, and compel all the people to stay in it until the fire had burnt itself out? (Laughter and applause.)

Dr. James.—Our rule in that case would be to carry them out,—to carry them to a place of safety. Dr. Bell does not seem to have understood me. My idea is this: In nearly all of our cities we have places to take care of these infected persons, and my idea is that they should be placed there, put in these hospitals when they are sick, and not that they should be allowed to remain anywhere and everywhere and infect other people.

Dr. Steuart, of Maryland.—I want to call attention to one thing that has not been touched upon, that is the danger that occurs from public funerals. That is a point not touched upon; and if the health officer and the authorities of every city where small-pox occurs would prevent public burials of small-pox patients, the danger would be very much

lessened. I know that in an epidemic that occurred in Baltimore two or three years ago the great start the disease obtained was from a public funeral, which took place in a church. Five or six hundred people were present. In that locality within two or three weeks the disease was dotted around in four or five houses, and hundreds of cases came from that one cause. If the authorities will take possession of a house and watch every case as soon as it is reported, and have reports made daily to the health authorities, and when death occurs take possession of the house and of everything that had been in contact with the patient, and destroy it, and disinfect the house properly, and more especially the body—for we all know how malignant a disease is when taken from a corpse—infection may be prevented.

Dr. Germer here made some remarks in regard to infection from rags brought over by ships, stating that he thought that before shipping the rags they should at least wash them, as there was plenty of water in the world, and that when they came over in ships infected with disease, he was in favor of disinfecting them with a three hundred pound bombshell. (Laughter.) (The amount of noise and confusion in the room during the delivery of Dr. Germer's remarks prevented the stenographer from securing a report.)

Dr. Newell.—The two great weapons that the anti-vaccinationists use, I believe, are these: Injury done to the system by vaccination, and the effects produced by it. Now this is owing, if it ever occurs at all, to vaccine virus being impure. I understand there are manufactures of an article that is not true vaccine virus. We cannot be too particular in using virus. If we take care in this direction, we can cause this weapon which the anti-vaccinationists use against us to be of no avail. Now I wish to impress this point on this association, and the public should know it generally. I think they cannot know it too well. A person should be vaccinated until the proper results are produced, whether that be once, twice, or three times. In foreign countries, and it is beginning to be introduced here, the mode of vaccination is to vaccinate not only in one place, but in three or four. I have myself for years carried out a system, where the patients would allow me, of vaccinating on each arm. I find where I do that the sores are not larger necessarily: the inflammation seems to be divided between each sore, and the sores are smaller than they would be on one particular point. I go further than that. If that first vaccination has taken properly, I vaccinate again, and if that still shows the same symptoms, I vaccinate again. I find by doing that, the person is perfectly secure. But if you vaccinate once, and there is a sore, and you do not follow it up by succeeding vaccinations, the person is liable to take small-pox. He may not die from it, but yet he takes the disease. Then the anti-vaccinationists say "There is a man who has been vaccinated thoroughly, yet he takes small-pox, and has had it severely." We should carry this principle out as thoroughly as we can, and keep on vaccinating, until the result obtained is perfect security, and we will reduce to a minimum the weapons of these men.

Dr. RAYMOND.—I have never heard a stronger argument that could be used by those opposed to vaccination, than the statement that impure vaccine virus is manufactured; and I would like to know upon what it is made, and whether it is made in the city of New York. The sooner we know all about it, the better.

Dr. WATSON, of New Jersey.—I wish to answer that gentleman by saying that the authorities in New York have examined the vaccine virus that was sold there, and they have discovered that virus was manufactured, I believe, from a preparation containing tartar emetic. At least, I understood so.

Dr. RAYMOND.—I saw this notice in a paper, and I never saw any contradiction of it.

Dr. WATSON, of New Jersey.—As there are two more papers to be read this morning, I move discussion on this paper now be closed.

Dr. SMITH, of New York.—I wish to say, for the past six years I have been a member of the New York State Board of Health, and in that time there has not been any reported manufacture of vaccine virus, nor has there been any examination by that board, or under its authority.

Dr. CONN, of New Hampshire.—I want to say one word in defence of the health boards, not only of New York, but all over the Union. I believe it is our duty to get as near perfection as possible in all matters pertaining to health; and that we should knowingly allow any such thing as manufactured virus to be used in our cities, would cast a serious reflection on the authorities of this country. I go one step further than my friend from New Jersey,—

The PRESIDENT.—I think, as we have two more papers to read, the debate on this should be closed.

Dr. JENNER.—I move that debate proceed *ad infinitum.*

The PRESIDENT.—It is moved and seconded that Dr. Conn be allowed to finish his remarks.

The question was put, and the motion was agreed to.

Dr. CONN.—Gentlemen, I thank you for your kindness. I have only one word more to say. Instead of laying the blame on the manufacturer, take part of it home to yourselves. You approach your patient with unclean hands. You fail to properly cleanse the arm to which you are going to apply the virus. You are not sufficiently careful to see that the person has on clean garments. In other words, you use less care as to cleanliness than you do when you approach a woman to perform the operation of ovariotomy, when you should use the same care. When you believe this, and take these precautions, you will disarm the anti-vaccinationists, and you will have less of this trouble to report as being from impure manufactured virus.

Dr. JENNER.—I would like to say a few words.

The PRESIDENT.—Debate has been closed.

Dr. JENNER.—I beg your pardon. I moved that debate proceed *ad infinitum.* I do not know whether you know the meaning of the words or not. (Laughter and applause.)

The President.—The Chair did not so understand the gentleman's motion, and if there is no objection, he can proceed.

Dr. Jenner.—Mr. President and Gentlemen: There are two most important points which have been lost sight of in this much discussed subject. First, the care that is necessary, and second, the character of the vaccine virus. To my certain knowledge, owing either to the character of the virus or the carelessness of the vaccinator, in my experience of fourteen years there is not more than one in ten who will show a good square mark. I believe it is a positive necessity that the vaccine virus should be inserted in both sides of the body; and, under all circumstances, I should consider no person had been vaccinated until he could show a proper vaccination mark and certificate to not merely a scratch on the arm, but a real, true vaccination. If that has been done, the person is protected from small-pox. Vaccine and variola are identical, the one in the cow and the other in the man. If I had time I could prove it, but they will stop me in five minutes. Yes, I can prove it. I had the honor to be called Jenner, and Jenner I am, and Jenner I am related to—the discoverer of vaccination. He did not commence with bovine virus, but he commenced with stuff taken from the hands of dairy maids who had milked cows. It may not be generally known, but it is a fact, nevertheless, that cow-pox is the same thing in a cow that variola is in a man, and they are convertible. I have had patients under my care, and have examined their marks that had been there fifty years, and were as perfect as on the day when they had been vaccinated. Yes, if I had an hour, I could bring in the proof now. (Laughter.) I believe in practical talk, and not in jaw. (Laughter.) I say that vaccine virus should be fluid, and it should be clear and transparent; and the next best thing to this is a pure, clean piece of ivory, dipped well in the pure vaccine and allowed to dry.

A Member.—Why is it that you wanted both sides vaccinated?

Dr. Jenner.—Why, you have got two sides to your body, have you not? (Laughter.)

The President.—The gentleman's time is up.

Dr. Jenner.—Oh! I am so sorry.

A Member.—Just let me ask him this question, whether he has ever seen a case of variola on one side of the body. (Laughter.)

Dr. Jenner.—Oh! I must answer that, Mr. President. I must answer a question. I am not so impolite as the fellow who refused to answer me a question the other day. Sir, I have seen vaccination take on one arm and not on the other.

A Member.—At the same time?

Dr. Jenner.—At the same time, sir.

A Member.—But my question was—

Dr. Jenner.—Never mind about your question. I am answering it straight. I have seen vaccination take on one arm and not on the other.

Dr. Armstrong.—Some of the gentlemen seem to think that vaccine virus has been manufactured. While I have never seen manufactured

virus, it was my misfortune once to see something as closely resembling it as could be possible. Gentlemen will remember receiving two or three years ago some lymph, brownish looking in character; and it was stated that all that was necessary was to scrape a little of this matter and wet it with water, and vaccinate as usual. I tried it in two cases, and I think the worst case of erysipelas followed which I have ever seen. An examination was made, and it was found to be composed of epithelian scales of hair and other foreign substances. The matter was called to the attention of the profession in some of the public medical journals of the United States. I think also it was mentioned in a paper before the American Medical Association, at Cleveland, by Dr. Martin: not only one, but many instances were enumerated. Furthermore, possibly it was brought before this association. I know Dr. Martin was trying to get a detail for that purpose.

Some vaccine farms get a reputation for furnishing pure lymph, and have such a demand that they get to furnishing lymph thas is insufficient in strength. I have known several instances of this kind.

Dr. Bailey(?).—Allow me to say, that that was fully discussed at Indianapolis, and I move therefore that this discussion be closed.

Dr. Cochran.—I second that motion, because evidently we have got all out of this discussion that can be obtained, and are only wasting time.

Dr. Bailey (?).—I think the matter was more ably discussed at Indianapolis, because I remember taking part in it myself. (Laughter.)

The association proceeded to divide on the question.

Dr. Hingston.—I was asked by one gentleman about public funerals.

The President.—It is too late, Doctor, as the association is now dividing.

The motion was carried.

The President.—The next business in order is a reading of the paper on "Impure Air and Unhealthy Occupation as Predisposing Causes of Pulmonary Consumption," by Dr. C. W. Chancellor, of Maryland.

Dr. Chancellor.—Before reading my paper, I desire to offer a series of resolutions in reference to the holding of a national sanitary exposition, and refer it, without being read, to the proper committee.

The resolutions were received and referred.

Dr. Chancellor's paper was then read. (See page 67.)

Dr. Adams.—The subject Dr. Chancellor has just discussed, it seems to me, is far more important than the one that preceded it, small-pox. What is true in one state is probably true of the whole country, in regard to this disease. The number of deaths from consumption is far greater than that from any other single disease. In Massachusetts, for fifty years, the number of deaths from small-pox has been about 5,000; from Asiatic cholera, a subject to which we have given some attention, the number has not exceeded 2,000; in the epidemics of 1832, 1849, and 1854, the deaths were 6,000; from consumption during that period, on the other hand, there have occurred at least 240,000 deaths, or nearly a hundred times as many as have occurred from cholera, and forty or fifty times as many as

have occurred from small-pox. It seems to me, therefore, that the question is one of far greater importance. The questions of climate, of soil, of moisture and dryness, and of inheritance, have all been brought to our notice in previous years, and it seems to me that this association, as an association, ought now to take a renewed interest in this subject of consumption. I think more can be done in relation to the prevention of consumption. It seems to me there are certain facts in relation to it by which it is shown to be to some extent a preventable disease.

One point that Dr. Chancellor has brought out prominently is that of crowded apartments and small-sized apartments. This subject I have, during the past year, paid some attention to, and have measured apartments in our own and other states, and noted the cubic air space in which people live and sleep. I have measured some rooms in which one or two persons sleep, which have not had more than four hundred cubic feet, some five hundred, and others six hundred. In one public house, every room, with the exception of the office and one or two other rooms in the first story, was a sleeping apartment, the average size of which was five hundred and twenty cubic feet. You can imagine the condition of these rooms in the morning, when people get up, especially when it is known those rooms had no provision for ventilation except one window and a door. This was a public house, for the purpose of entertaining the travelling public.

The size of shops in our state, in former times, was a matter of investigation, particularly the shoe-makers' shops. Each shoe-maker owned his own little shop, perhaps of six feet square;—in that, sometimes two, three, and four men worked, and, besides, a hot stove burned up the air of the apartment, and there was no ventilation whatever. I have noted the lives of some of those shoe-makers, and I know that the mode of life they live was an exciting cause of consumption in those men.

Another point of interest is that in regard to dusty occupations. While in private practice, I made several autopsies, as medical examiner in our state, upon persons where this question came up; and I remember one case of a moulder, who had worked in a factory where the dust of the material used was constantly inhaled by him, and in sections of that man's lungs there were parts that were about the consistency of good, hard shoe-blacking, and of the same color. His wife told me that he had constantly expectorated what had every appearance of being good ink. Although that may not have been a direct cause, I think it must have been an exciting cause. In another case, that of a grind-stone maker, there was found, on examining his lungs, some particles of this dust which had formed in stone as large as mustard-seed, and scattered throughout his lungs in various places. He died of consumption.

Dr. Quimby.—In considering the subject of consumption, we ought to make a distinction between consumption acquired from the causes enumerated, and that which seems to be hereditary. I think it will be shown from statistics that about 70 or 75 per cent. of the amount of consumption is produced by acquired causes, such as have been mentioned, and 25

per cent. from hereditary causes. If that be true, a distinction ought to be made.

Dr. JONES, of Massachusetts.—I have had occasion to make many autopsies of persons who have died,—mechanics who have died from phthisis,—and on examination have found that there was not tubercular phthisis, but that the lungs were filled with sandstone dust coming from articles which moulders use in forming their moulds. I have oftentimes examined under a microscope this material, which proved to be almost pure granite dust. Another point of some importance is, that a great deal of this dust is cast off from the body through perspiration. You would hardly believe it when I tell you that in many cases the clothing of persons working in iron, especially the night clothing, will be full of iron rust, caused by their perspiration. It was but a short time ago that I had a case of pneumonia in a tack worker, who died. His perspiration, after the most thorough bathing, made the clothing which he wore, and the sheets of the bed in which he slept, of a rusty iron color.

Dr. HERRICK.—I desire to give my views on this interesting subject. The paper presents very well indeed the subject as given in our standard authorities. They all call attention to these important facts in regard to the cause of consumption. I wish particularly in this discussion to emphasize the point that tuberculosis is produced by different causes. One form of lung disease is that derived from inhaling impure air, or the air of badly ventilated rooms, which is charged with carbonic acid gas. Here we have the respiratory function of the lungs directly impaired—an impediment, as it were, in the physiological process; and from this cause we have the true tubercular disease of the lungs. Dust produces, primarily, only bronchial irritation, which eventually develops into true tuberculosis. It seems to me this distinction should be made. It is an important subject, and the conclusions arrived at by Dr. Chancellor are fully substantiated by our best authorities, notably by the register-general of England, who reports, where the allowance of air space was something like 330 feet per capita, the percentage of death from consumption was 13 and a fraction, and in a branch of the army where the men were given 700 square feet per capita, the rate of mortality was something like 6 per cent.

Dr. JAMES.—I wish to say, in regard to this matter of Asiatic cholera and other epidemic diseases as compared with consumption, that these epidemics prevail for a few weeks, while the other goes on all the time, and if these epidemic diseases had prevailed all the time, no doubt the mortality would have been much larger. I notice that if we introduce into the system of animals tubercular matter given them in their food, we find the disease is set up in the bowels, or in other portions of the alimentary duct, and extends to the whole system. If we put in ground glass or steel filings, we would get an inflammatory condition, and might by the constant presence of minute particles produce an entirely different disease; and yet it might be a wasting disease, and might lead to death from pulmonary disease. I think our line is not distinct enough. There

is a form of pulmonary disease produced by tubercles alone; then there is another arising from an inflammatory condition of the lungs. From the presence of these causes, irritating the bronchial lining and keeping up a constant inflammatory condition, the system wastes away, and then comes death by what we call consumption; but this I do not consider tubercular, or true, consumption. I think true consumption is produced either by hereditary tendency to consumption, or it is introduced by inhaling the atmosphere of consumptive cases. I believe a large number of our cases of consumption are nothing more than the result of over-work, the breaking down of the system, the lungs being the most susceptible part. I think the average of lung diseases, as compared with the ordinary run of diseases, is about five times greater than the ordinary diseases of the other organs. Therefore the chances are five to one that the lungs will be affected, and when the system is broken down from loss of rest, or from the breathing of impure air, or in any other way, the lungs are liable to be the first organs attacked. I think that is one reason why we have so many cases of consumption. (Applause.)

Dr. Bell.—I want to say one word in regard to this question. Dr. Budd reminds us of the generally accepted knowledge of the great prevalance of consumption along our Atlantic sea-coast. I think he lacked one word of fully expressing the case. He needed two adjectives instead of one. When he said soil moisture, had he said *dirty* soil moisture he would have comprehended the question not only there but everywhere else. There is a larger per cent. of deaths from consumption in the District of Columbia than there is in New England. What is the cause? Is there any other population in this country which furnishes so many clerks, so many persons shut up in dark rooms or dark cellars? I am thoroughly convinced in my own mind that at least 75 per cent. of consumption is created by these causes. I have very recently heard a paper read before the New York Medical Association, taking the ground that consumption is never hereditary; that it is one of those diseases not hereditary. The author brought a mass of testimony to prove the point. He cited a great number of examples like this. He said, here are so many persons, so many among them have had consumption: how many had typhoid fever and died of it? Then, if consumption is hereditary, why not typhoid fever, which shows a larger percentage owing to foul soil, or foul rooms, and other foul surroundings of different kinds. Then he cited malarial cases, and showed that they amounted to two or three times the number of consumptive cases. Then he took another class of cases, and pointed out where persons were supposed to be infected with consumption by inheritance—cases where a parent, or some more distant relative, had died of consumption; and he showed that it depended on the occupation of the descendants whether or not they died of that disease. He cited the case of an agriculturist who had plenty of pure atmosphere, and he attained to the age of three score and ten years. Then he showed other cases where they were surrounded by conditions which gave a tendency to the development of the disease, and where the person died of consumption.

Dr. James.—I want to say one word for Washington in regard to the cases of consumption. I have been through most of the departments, and I do not know where I have seen places, the entire arrangements of which were better calculated, as a general rule, for the promotion of health, than they are in the departments around Washington. I can hardly think that these departments and rooms are so constructed that they would be sufficient to cause large mortality. Dr. Bell compares New England, where the whole population is taken, to the small area of the District of Columbia. Now where you have a large rural district it makes a great difference in the percentage.

Dr. Germer.—I think that we should have better houses and better workshops and shorter hours for the working people, and better pay in some of the shoe factories. The trouble is, they do not make money enough to keep body and soul together.

Dr. Quimby.—This subject is a very important one, and we owe it to ourselves and the people we represent to advise our constituents how to prevent, if possible, the great mortality from the disease which we call consumption. The people object to laws which take from their pockets money for the construction of buildings. But if any one would invent some means of constructing a house on sanitary principles, so that the largest amount of fresh air would be admitted without cost, he would be doing a great service. This might be done by running a shaft from the cellar and connecting it at the other end of the house adjoining the kitchen, and making a circulation through the house, leaving a brick out under the window in every room in your house. This I think would give ventilation without expense.

The next question is, whether or not this record is true; whether this large number of persons die of consumption; whether you are careful enough in making your diagnosis; and whether a larger number is not returned than is really true. I think you owe it to yourselves to protect your neighbors. These life insurance companies are making use of these figures, and you will do your constituents great injustice by not being more careful in your reports. I have many reasons for believing these reports have been carelessly made. They include cases from three years up to seventy or eighty years. It is not fair to do this. The irritation of the lungs is caused by some foreign substance. Irritation is kept up and retards the constant repair that ought to be going on, and thus you make an irritable surface for the reception and production of the bacilli that produces consumption. There is the whole history of it.

The President.—I desire to say that what Dr. Budd has said is not only true, but fearfully true. But I should like to supplement that declaration by a remark that there is no greater mistake made in the practice of medicine than the returns concerning consumption so-called. Let me state, from my own personal experience and observation in the city of Wheeling, where the business of the town is carried on by iron manufactories, that we have what is called Nailers' consumption, but I believe that more than 50 per cent. of the number of such deaths are from pulmonary

tuberculosis. It is merely fibroid phthisis, commencing first as bronchitis, and then incidentally pneumonia, and finally death, and the return is consumption. Let me give you an instance which means more than I can tell you. One morning, on starting from the house, the sun was out, and everything was unusually bright in Wheeling, and I saw before me on the pavement fresh expectoration. It looked to me as if it were tuberculosis. I picked it up, with a clean match from which some gentleman had lighted his cigar, and took it to my office, and it was absolutely loaded with tubercular bacilli, and I made one of the best specimens I have ever seen. This expectoration will dry, and passers-by who have congenial soil will take it into the lungs, and off it goes. That is one of the probable means of communicating the disease about which you are talking.

Dr. Chancellor.—It may probably be well for me to state that I think the scope of my paper has been somewhat misconceived, inasmuch as I discussed only the inhaling of impure air and unhealthy occupations as predisposing causes of pulmonary consumption. Further than this I did not propose to go, either into the etiology or the pathology of the disease. There are, of course, many circumstances, such as dampness and dirtiness of soil, absence of sunlight, improper food, heredity, etc., which may and often do play an important part in the development of pulmonary consumption. What I wished to illustrate is the sadly numerous class of cases resulting in pulmonary consumption from employés' breathing the impure and dust-laden air of badly ventilated counting-rooms, factories, and workshops, to the end that the evil may be arrested, or at least mitigated.

The President.—It will be remembered, in the experiments made by Doctors Formard and Sternberg in the city of Baltimore with pulverized glass, that it was injected into the lungs of rabbits without producing consumption to the animal, and the animal was as well afterwards as before.

Mr. Lomb, of New York, introduced a resolution recommending the creation of a commission to investigate the dangers to which workmen are subjected in factories, workshops, etc. Referred to Executive Committee.

The President.—Dr. Raymond, the report of the Special Committee on Disinfectants is now in order.

Dr. Raymond.—I hardly think that it is necessary to make a formal presentation of the report, but if it is in order I now formally present it.

Dr. Hunt.—That is certainly one of the most important reports that will come before this body, and the time is exceedingly late. I do hope there will be time given for the discussion of that report. Dr. Rohé understood it was to be presented to-morrow, and he is not present; and I, for one, while I have intense admiration for the thorough work done by the committee, should not be willing to have that report go forth from this body without some discussion. I move you, sir, that it be put on the programme for to-morrow as the first matter for discussion.

The question was taken, and Dr. Hunt's motion carried.

The PRESIDENT.—I have been requested to state that there will be a conference of the representatives of the state boards of health in parlor No. 10 immediately after the association takes a recess. The advisory council meets at 3 o'clock.

The chair then filled vacancies on advisory council. Then on motion the association took a recess until 3 o'clock P. M.

AFTERNOON SESSION.—3 O'CLOCK.

The recess having expired, the association was called to order by the president, who announced that the first business in order was the report of the Committee on State Boards of Health, which would be submitted by Dr. Conn, of New Hampshire. (See Reports of Committees.)

The report was read by Dr. Conn.

The PRESIDENT.—Discussion of the matter is now in order, and to secure uniformity I will begin with the several states.

When the state of Indiana was reached,—

Dr. METCALF said:—We have nothing new to suggest. We are working slowly in Indiana, and feel that we are doing our whole duty, and making an honest endeavor to prevent contagious disease and to preserve the health of our citizens. We have no new ideas to advance at this time.

Dr. KENNEDY, of Iowa.—I do not know the scope of the report that you expect, whether it is verbal, or whether you desire merely a statement. I want to say for Iowa that we have a good board, and the people are giving it hearty support. We have a law that gives us almost absolute power. While we have not compulsory vaccination in our state, we have almost the next thing to it. The board requires the vaccination of all school children between the ages of five and twenty-one years, and that a record be kept of them, so that we know the status of our children on that point. We have also urged a law in regard to public funerals, not permitting any public funerals in case of persons dying with contagious disease,—measles, scarlet fever, and that class of disease.

Dr. MCCORMACK, of Kentucky.—I would say that this meeting is rather a surprise to the representatives from most of the state boards of health. I think that most of them had the idea that any report they had to make was a written report to Dr. Conn's committee. I think that there has not been a general understanding of the fact that they would be called on for a special report. I say it in explanation of my own board.

The PRESIDENT.—It is the duty of the Chair to call on the states. It is true that the chairman of the Committee on State Boards of Health has reported in detail from several of the states whatever has been reported to him as chairman of that committee, but all the states have not been heard from.

Dr. J. N. McCormack, of Kentucky, says that conceiving it proper to deal as plainly and frankly with this association as his board deals with their own people, he must report that owing to limited funds and the imperfect organization of their local boards of health, the sanitary condition and the status of the health authorities in that state are not so good as many other boards are able to report, but that in spite of these obstacles a substantial and gradually increasing progress has been made. This is shown by the character of the work done by the health officials, as well as by the increased interest taken in sanitary matters by the people and the public press.

Although the state has been singularly free from contagious and infectious diseases since the last meeting of this body, the year has been one of much more than usual activity there as elsewhere, largely on account of the threatened invasion of Asiatic cholera. While cholera did not come this expenditure of time and money was by no means lost, as is evidenced by the diminished sickness and mortality from our every-day home plagues. This has been so marked in the cities and towns which have been most active in this regard as to attract the attention of the public as well as the medical profession.

At the last meeting of the legislature the laws of health were made a part of the regular course of instruction in every public school in the state. In carrying out this most excellent provision, which lies at the foundation of all permanent health reform, the authorities have had their greatest difficulty in finding text-books suited to this purpose. The state board of health has collected in its library almost every text-book on school hygiene in the language, and while they have found very many which, in so far as they relate to anatomy and physiology, are probably all that is to be desired for use in the higher schools and colleges, they have found nothing which, in language adapted to the comprehension of the children of our common schools, conveys the information in regard to the prevention and restriction of infectious diseases, water-supply, ventilation, and other practical sanitary subjects, which we consider of vital importance, and which, properly taught during the school course, could not but have the highest and most beneficent influence in moulding the future of the individual and the nation. It is the habit of sanitarians to complain, in and out of season, of the ignorance and indifference of the legislators and public of our own time; and yet it must be confessed by every thoughtful man among us, that in this country at least no adequate effort is being made to prevent the same conditions in the future. Sending out health circulars, tracts, and reports is not quite so hopeless a task as that of Sisyphus', but it must be confessed that except in the presence of a threatened epidemic, as a reserve to the attacking force, they have little weight or attraction for the average free and enlightened American citizen. These are unpleasant and unpalatable statements, but it is believed that few who have had much experience with legislation, when they are brought in contact with fairly representative men of the better classes, will question its truth. With the cry that is abroad

for higher education, for teaching our children the higher mathematics and Greek and Latin, and instruction about the rivers of Africa in which they will never bathe, and the mountains of Asia which they will never climb, let us send out a plea for instruction in regard to the plain laws of health, instruction that will be useful during every day of after life. To do this effectually we must have something different from the text-books on this subject now before the public.

Of the routine work of our board I will not speak, but there are two points of special work which may be worthy of mention. During the last winter an investigation was made of the cause of a fever endemic, which had continued in the city of Louisville for several years. This report has been widely published, and is probably familiar to many of you. In the face of the many difficulties, it was found impossible to reach conclusions as definite as was desired, but a system of unsanitary conditions and disease-producing agencies was found to be fostered and kept up by the city government in the form of leaking privy vaults and surface wells in close proximity to each other, in a highly porous soil, which with their attendant defects made it a puzzle why the results were not worse. No perceptible result has been obtained from this suggestion, except the worthless suggestion to improve the water-supply by substituting bored wells sunk seventy-five feet into gravel for the present brick and cement wells which are from thirty to forty feet deep.

The other point was an outbreak of contagious pleuro-pneumonia in cattle in one of our counties, from an importation of diseased cattle from Illinois. We had no laws which met the emergency; but the interests involved were so great, and the damage threatened to our food-supply was so important, that our board undertook to stamp out the disease with the freely accorded and invaluable assistance of the U. S. Bureau of Animal Industry. The disease had made considerable headway before we were asked to undertake its control, but all infected and exposed animals were rapidly gathered into suitable quarantine grounds, the diseased animals were slaughtered, and there is every reasonable ground to believe that the disease is now practically exterminated.

Dr. Garrish, of Maine.—I was not expecting to make a formal report, but as there seems to be plenty of time, owing to lapses on the part of some of the states, I will make a statement. I would say, first, in reference to the method of getting a state board of health in Maine, the method proposed is not unique, but it is one which has not been generally adopted, and the statement may be of use to those gentlemen who are working in states where there are no state boards as yet. In previous years it had been customary to go before the state legislature and enlist the sympathies and interests of some of the members, and get them to advocate our cause by speeches, sometimes by eloquent speeches, in the two branches, and they have always failed. Some of us thought it were better not to attempt that method again; that it would be well to have a still hunt, and to avoid particularly any such thing as speech-making in the legislature; so, before the legislators went to our state

capital, every one of them had a document with him to explain what was wanted. A personal letter was written to the doctor in the immediate vicinity of every member of the legislature, care being taken to select his family physician where it was possible, and he was communicated with by a personal letter, not printed, but written, enclosing a stamped envelope directed to the chairman of the committee. He was requested to inspect the printed bill which was sent with it, and call the attention of his representative or senator to the subject. There was likewise enclosed to him a sanitary tract, explaining as briefly and pointedly as possible the object of state boards of health. The result was, when the legislators went to Augusta almost all of them were filled with the measure. Thus our physicians, who from indifference or lukewarmness had failed to attend to the matter, found that their opposition was not in an atmosphere which was favorable to its development; and to make the story short, either by some little skill in depressing legislators who were desirous or anxious to air their oratory, not a speech was made in either branch, not a "yea" or "nay" vote was called in the house of representatives, and there was but the slightest ripple of opposition in the senate, it being caused by a certain senator who had all through opposed appropriations for new things. While he said it would be a good thing, still, in order to be consistent, he must make opposition to it, as an appropriation of $3,000 was called for. There were 3 votes in opposition out of a possible 181. It went through without a change of three words in the bill as presented. While it was not as stringent in its provisions as it might have been, it was probably as efficient a bill as could have been passed, because if it had been stronger it might have caused opposition. The board was organized as soon as possible after the appointment was made, and went immediately to work. Our principal work has been the protection of the state against small-pox. In the outbreak in Canada we found our great opportunity. I have no doubt if the matter of creating a state board of health had been put to the popular vote last year, there would have been very little interest in the matter, and probably the vote would have been against us. If it were put today, I have no doubt that we could get an extension of the $3,000 appropriation to $5,000 per annum, and $5,000 as an epidemic fund per annum, to be used if occasion required. We have demonstrated the necessity of the board. We have caused organizations of local boards of health in the most important places. We have stirred up municipal officers. We have some pride in making the statement that although up on our north-western, northern, and western border we have the province of Quebec and the province of Brunswick respectively, up to the present time, since the epidemic in Montreal, but two cases of small-pox have occurred in Maine; and I believe the people are convinced that this result, which is very gratifying to them, is due to the fact that they have a state board of health in Maine at last. (Applause.)

Dr. Baker, of Michigan.—I did not come here to say anything, because I understood what we had to say was to be sent to the chairman of

the committee. I would like to add, however, that our board has been unusually active during the year, and the people have been unusually active, because of the dangers threatening from abroad; and one effect, in connection with that which we believe has some relation to this activity, is, the year has been remarkably free from sickness. There has been very much less sickness in our state than the year before. We know it because we have means of collecting reports in regard to sickness, and so we are enabled to make that statement positively.

Dr. Cox, of Missouri.—I have not a great deal to add. We are just getting under good headway. The people are becoming aroused. We have given some attention to the vaccine farm of the state university, from which we expect to have pure virus. Next year we expect to make reports in regard to the school buildings of the state, and other matters pertaining to schools. We have made a report on the water-supply. The town in which I live has magnificent water, which has its origin from a spring in the mountains, and is very pure. We have 15,000 inhabitants, and get along very well.

Dr. Conn, of New Hampshire.—If the conference will allow me to explain, I would say that I was unable to say to the members in my circular that there would be a roll-call of the states. That has been a privilege granted by the Executive Committee since we came here. Of course, therefore, many are unprepared; but it was understood last year that each state should be called upon, and a report should be submitted to the Executive Committee.

In regard to New Hampshire, our work has been similar to that of former years, with the exception, as has been stated by our friend Dr. Garrish, of Maine, that we have had this epidemic in Canada to contend with. Our people naturally became frightened, and demanded protection, and we have done what we could; and since we commenced our inspections we have had no small-pox in the state. There is but one incident in connection with it that is worth reporting, and that only because of showing how, when people are informed on the subject, it does away with this feeling against vaccination. The only case of small-pox in the state was one family that came directly from Montreal, and in due time had the small-pox. It was recognized at once, and they were isolated and taken care of. Three of the members had been vaccinated, and three had not. The deaths were the three not vaccinated. The man who was the head of the family proved to be a man of intelligence, being able to read and write English and French. The city of Manchester immediately employed him, as he was a thorough friend of vaccination. The result has been, that of one thousand people from Montreal and Canada that have been taken into Manchester, all have been passed through his hands. We have had no small-pox since. Every precaution was taken against the spread of the disease in this case; and, as I have stated, there was no spread of the disease, although we know that many people came from infected districts, and some immediately from the infected house where they had been engaged in nursing the sick. (Applause.)

Dr. Hunt, of New Jersey.—I have nothing especial to say that is different from what has been the course of the health board for several years past. We congratulate ourselves this year, however, that the laws have been tested as never before, under appeal to the court of chancery, the highest court of the state, in several instances, and have there been sustained throughout; and it has aided very much in the formation of local health boards. The work of the year has been that of house to house inspection, and of school inspection, and both of these have been carried on to an extent never before attempted. We feel that very successful work has been done in that direction, not only in getting details of great interest to the state board of health, but also in enlisting the teachers of the state and others in this work. We have been able to put in book form all of our vital statistics and reports, so that they can be carried about and the blanks filled out easily, and we have also convenient books for house to house inspection. I think I have nothing more to say.

Dr. Raymond, of New York.—I am not familiar with the work of the State Board of Health of New York.

Mr. Brooks, of New York.—I will venture to say a word or two in the absence of Dr. Smith, and as the chairman of the Executive Committee of the State Board of Health of New York. Apart from myself, I wish to say that I think we have a very efficient and complete organization of the state board of health. As I said last year, and as you all know, the territory covers about 1,000 towns, 240 villages, and 24 cities. In all the cities and in all the villages, and in a majority of the towns, there are local boards of health. In the great cities of New York, Brooklyn, Buffalo, and Albany, and in some of the smaller villages, one of them at least, Yonkers, there are independent organizations. My own judgment is, that except for great cities like New York, with its at present 1,000,000 of people, Brooklyn with its large population, and perhaps Buffalo and Albany—I will exclude both Buffalo and Albany—there is hardly any necessity for independent boards of health. Nevertheless when these applications for general health purposes are before the legislature, some of the members become so persistent to have their localities excepted from the general law, that it has been deemed expedient to acquiesce in such a demand rather than to fight it, in the hope and belief that experience will show the wisdom of trusting—with the exception of the three great cities—to local boards of health to execute authority for themselves. I will state in regard to the legislature—the last legislature, when the state board of health made an appeal for an additional law to give them authority over local boards of health where they failed to discharge their duty in protecting the people at large—the state board of health was given authority to make such appeals to them, which if not recognized and answered an appeal was to be made to the governor to execute such coercive measures as might result in the public good. Another feature in our state board of health is this,—that we have endeavored to have established in the local boards of health at least some one competent person, through a civil service examination as to his fitness

for that position, to be qualified as a member of the local board of health. The custom has been to make one supervisor, one justice of the peace, and one health officer selected at haphazard, the local board of health of several towns. The fact is, in regard to the supervisors very often, and in regard to the justices of the peace very often, both of them being elective officers, that they are not qualified to discharge the duty which belongs to the local health officers. So upon the whole I may say that we have been improving from year to year until the state board of health feels at the present time that it has an efficient organization in regard to the several villages and towns, and most of the cities, of the state.

Now you will be interested to know how much the city of New York expends on this board of health. The appropriation generally is for general purposes $20,000 a year. We pay our secretary, who is the executive officer of the board, $3,500 a year. Dr. Carroll fills that office, and is the successor of your friend and my friend recently dead, the lamented Dr. Harris. In regard to the expenditures of the city, my friend from Brooklyn can give you much more information on the subject than I can. The city of New York expends for health purposes between four and five hundred thousand dollars a year, and conducts this business in a very efficient, determined, and successful manner. I believe the city of Brooklyn expends about $75,000 a year: so you will see the large interest felt in that commonwealth in regard to the maintaining of health in the state.

I want, what I have very seldom had the opportunity, privilege, or desire to do, judging from past experience, to thank the president of the United States and the authorities here for their response made to the appeal of the state board of health after the introduction of small-pox into Canada, in regard to the extent of which you have heard so much; to say that, on the appeal made to them, in the absence or any state money to make proper examination of the country on the lake frontier, which has a very extended lake exposure, inspectors were sent from Washington, and we are indebted to them for the services which they performed. I think, therefore, as a citizen of New York, and as a member of the Public Health Association, I may congratulate the state, and I am sure that I may congratulate the country, that in that great commercial focus of the Union we have been so free from diseases during the past year. (Applause.)

Dr. Wood, of North Carolina.—Since the last meeting of the American Public Health Association, the North Carolina State Board of Health has been reorganized, and put upon a basis which is entirely satisfactory. Heretofore there have been no means within the power of the state board of health, and our board has been actually carried on by the members themselves from their own means. But the legislature of 1885 made an appropriation for the sustenance of our board of $2,000, and $2,500 contingent fund for epidemics, and also for the laboratory of the agricultural station for the analysis of food and drinking-water, an experiment set on foot by the state board of health. Although this is but elementary, it is a

great step forward, and we feel very much encouraged. During the year there have been no epidemics whatever, and there has been no call upon the fund, but we have succeeded in organizing over fifty counties. In each county there is a superintendent of health, and by the new law a superintendent has been provided with a salary which by the old law was not possible. There has been set on foot a plan for the registering of the vital statistics; and we hope very much from the future. Our board has only been organized since January, and it remains yet to be seen what the new law will do for us. At any rate, after several years of waiting and expense to the individual members of the board, we now find ourselves on an independent footing, which has been recognized by the state officials, inasmuch as we have been called on for our expert opinion in the organization of asylums, penitentiaries, and institutions for the deaf and dumb and blind; and all the institutions under the control of the state have been placed under the sanitary inspection of the state board of health.

Dr. Reed, of Ohio.—As this seems to be a sort of health experience meeting, I presume it is the duty of every good convert to respond. Yet it is very humiliating for us who belong to the black sheep of this great family of states, to come in and make a report from our state that so far we have no board of health. But I may say that it is not the fault of many of us that we have no state board of health, and it is our determination to persist in our efforts until we do get a state board of health, let it cost what it will. (Applause.) Our efforts in regard to the state board of health have been thwarted in various ways. Sometimes one thing has happened, and sometimes another. Some bills were too long, and some were too short; some bills wanted to regulate the practice of medicine, and some did not,—and the result is, it has been a failure. At present I think there is more interest taken in the state of Ohio in regard to the establishment of a state board of health than ever before. There was a division in the state society in regard to it. That division has been healed almost entirely, and last year an appropriation of $500 was made, out of the society, to pay the expenses of a committee which should take this matter in hand. That never was done before. Committees that were appointed from the state society were obliged to pay money out of their own pockets, or obliged to do nothing at all, and to make report to that effect. Now we have become concentrated in our efforts. At the last meeting of the society, it was determined among a majority of the members that they would leave no effort undone to secure the election of members to the state legislature who were in favor of a state board of health. How did we do that? Each member was constituted a committee. Each man was to go to his representative, Democratic or Republican,—you know our state is closely divided,—it did not make any difference which, and to secure a promise that he would support the bill for a state board of health, provided he was elected. If he said he would not do that, we would not vote for him. We held it as a sort of threat over him. We have canvassed the state thoroughly. We have

held on to that one idea, that whoever was elected, Democrat or Republican, he was to favor the passage of a bill for the support of a state board of health. We now have a committee appointed in the state society whose business it is to prepare, or aid in preparing, a proper bill. Last winter we had four or five bills. The trouble was, we had too many doctors in the legislature. The result was, every doctor voted against every other doctor. You know the result: a house divided against itself cannot stand. This winter we hope to avoid that, if possible. We hope only one bill will be presented. We hope this committee, which has ample funds,—not that we want to buy any votes, however,—will be able to succeed in getting a state board of health. We have this to contend against: Every quack who is driven from every other state,—and a great many have flocked into Ohio, like chaff before the wind,—in all our towns, big and little, is using his efforts to prevent the passage of the bill to create a state board of health. Every year that we delay we have the same thing to contend against in that direction, and it is to be hoped that our success this winter will be complete.

Dr. Ashmun, of Ohio.—Whereas we have no state board of health, we have many local boards already organized and at work, and have had for a number of years. I am a representative from one of the local boards here, and have been in the association for several years. The board of health I represent, located at Cleveland, a city of 200,000 inhabitants, spends annually $2,500 to $2,800.

In regard to this matter of board of health work, the local boards are active and alive, according to the sentiment of the community in which they exist. Some of them are doing very little, some very well. As to the prospects of our having a state board of health, I am somewhat skeptical. I visited the legislature three different times to present the matter to them. In every instance the committee unanimously recommended the passage of the bill, and one or the other of the houses of the legislature passed such a bill, but, as my friend said, the doctors killed it. The doctors there, at least those that go by the name of doctors, want too much or too little. Some doctors will not vote for a bill that does not contain stringent regulations in regard to the practice of medicine; others will not vote for any board of health that does affect the practice of medicine,—and so it has gone. I have already examined somewhat into the prospect for this coming session, and I say I can scarcely share the feeling of my friend, Dr. Reed, that the prospect is good. At least, I know that some of the best men I have talked with feel very doubtful. At the same time, we are ready to poll every vote from our quarter of the state, and all the votes from our quarter of the state can be guaranteed for the measure. I have seen every person representing our part of the state, and have his promise, which I am sure will be kept. At the same time, I am afraid of some doctor who may get on the committee and make trouble. It is unfortunate to make such statements in regard to the profession, but it is literally true in Ohio.

Dr. Fisher, of Rhode Island.—I have labored under the same mistake

that some of my brother delegates have spoken of, in relation to the proceedings this afternoon. I can report for Rhode Island a considerable advance in the practical performance of any measures calculated to improve public health. I am happy to say that during the year, at the last session of the legislature, or at the January session, for we have two each year, there was a bill passed in Rhode Island explaining what constituted a nuisance—nuisances detrimental to health. Now perhaps right here I may say that in Rhode Island, more than in any other state in the Union, there is a very strong idea of personal rights. You know Rhode Island claims that Roger Williams was the first exponent of religious liberty, and the people and the legislature seem to believe that the government of Rhode Island was first to give every man the right of private judgment in all matters pertaining to conscience, and that comes down a good way. It even went so far at one time as to give a man a right to live in as much filth as he saw fit. You see how it might apply. Now I may say there has been a good deal of difficulty in getting special legislation in regard to sanitary matters. The bill establishing a state board of health was a surprise to a large number of the people of Rhode Island, and it has been believed that if an individual who was then a member of the judiciary committee of the senate had been there, and if it had not been for a senatorial courtesy, the bill never would have passed. I know of two individuals who had in their pockets, as they said, addresses or arguments against the establishment of the board.

During the winter session of the legislature, a bill was passed defining what constituted a nuisance, and also making it mandatory on the part of the town council, who are by law in Rhode Island boards of health for their respective towns, to make it obligatory on them to have a health officer, and, in addition, public health sentiment has advanced so that they have felt called upon to appoint competent men. Bills in the legislature, designed to bring about the establishment of boards of health in towns, have never gone far. They have many times never been reported from the committees to which they were referred, and sometimes they have been laid on the table to be taken up again, or have been postponed indefinitely. Now the councils have appointed boards of health in every town in the state, and I have had correspondence with a large number of the health officers appointed by the town councils, and I know that a large number of them have been active. They have been, as has been reported to me, mousing about. They have been sticking their noses into all sorts of places, to the disappointment of persons who occupied the premises. Of course it has been characterized as a monstrous thing on the part of the legislature to appoint men who have not the courtesy and gentlemanliness to keep out of certain places and premises. There has been, during the past summer, a great deal done in the way of cleaning up foul spots, and a great deal done in the way of removing public nuisances which were detrimental to health.

During the year I have had correspondence with a large number of the superintendents of schools. There is a law regarding vaccination of

all children that attend public schools; that is, no child shall go into a public school without presenting a certificate to the teacher—I mean for the first time—that he is protected from small-pox. Well, the law has been in operation on the statute books for over fifteen years. It has not, however, been so fully enforced as during the past year. Through legislative enactment, and the penalty attached to the action of any teacher receiving as a pupil a child who does not comply with the law, much has been done to bring about the enforcement of the law. I should think two thirds of the inhabitants of the cities have had correspondence with me, or interviews with the health officers or some person connected with the health department of the town, in regard to vaccine material to be used, and how the vaccination should be done. So far as the vaccination of the citizens is concerned, the epidemic of small-pox in Montreal has no doubt given it a large impetus. Many of the manufacturers have required on the part of their help a certificate in regard to vaccination. There are employed in the mills of Rhode Island a number of Canadian French. As a body they have been opposed to vaccination, and only a few years ago the French doctors in the state opposed it. I am happy to say they are now its friends, and have done a great deal in the way of vaccination among their own people. I may say, too, in Rhode Island the priests of the Roman Catholic church have had a large influence in bringing about the vaccination of the French residents, and very little opposition is now made to it. To my own knowledge three fourths of the towns have provided for vaccination for all the citizens during the last summer. I think Rhode Island has been better protected from small-pox for several years than most other states because of the requirements in regard to vaccination, and in the cities and towns it has been enforced for quite a while.

There has been some change in public sentiment in regard to other matters. Rhode Island is a manufacturing state, and there are manufactories on almost every stream that can turn a wheel large or small. There has been an attempt made in the legislature to give the state board of health the power to investigate the pollution of streams and to abate that pollution, but these bills have never gone further than the pockets of some member of the judiciary committee, into whichever branch of the legislature they have been introduced. Some few have reached a vote, and every manufacturer voted in the negative. The fact is, the manufacturers of Rhode Island do not want to be hurried. They did not want anybody to cause them expense, and of course of necessity it must take a great deal of money to bring about a change. Let me say that in the last five years I have personally visited a number of the proprietors, and represented to them the danger to the public health, especially on those streams from which water was taken for domestic uses, I mean for household uses; for there are several towns in Rhode Island which make use of water drawn from these streams on which there are manufactories. Some of them were inclined to look at me with a kind of look which said, What business is it of yours? and I

made little progress. During the last two or three years the cities and towns have been awakened, and the superintendent of health has visited these manufactories again. Quite a number of the proprietors have removed from the rear of their manufactories the water-closets which were almost invariably attached to the establishment, and immediately over the water. Then, again, there were many of the houses of the employés who had their privies hanging over the stream. This, in addition to the pollution that would come from the woollen and cotton mills, bleaching establishments, and printed cloth establishments, of course made the stream filthy, and the idea of drinking such kind of decoction was not pleasant to those living in the towns. They have been largely removed, and I do not know of one now remaining.

I make this statement to show there is a movement in Rhode Island. But I am taking up too much time, and I will now close. My object was to show that Rhode Island is not lagging, and that there is a progressive movement.

Dr. THORNTON, of Tennessee.—I have very little to state in addition to what has already been written and read by the chairman of your committee. However, I will say this, which is unfortunately omitted from that report, namely, that the State Board of Health of Tennessee has been very materially strengthened by the last legislature by two acts, one of which gave an additional appropriation of $10,000, and $5,000 to be used exclusively as a reserve fund for quarantine purposes for the prevention of the introduction of infectious or contagious diseases into the state, and the prevention of their spread, and for other purposes. Another act was passed, creating county boards of health, to be composed of the judge of the county court, the clerk of the county court, and the health officer who is a physician, and the jail physician, and county health officer. This officer was required to report any case of infectious disease, such as cholera, yellow fever, etc., which might occur in his county to the secretary of the state board of health. The law has not yet been in force sufficiently long so that any particular benefit may have been derived from it, though I am very well satisfied that its operations will be in every way satisfactory. The board has published a report covering a period of four years, which has been, I believe, favorably received and commented on.

Dr. SWEARINGTON, of Texas.—The state of Texas has no state board of health. In lieu of it the governor appoints a state health officer who has an annual appropriation of $40,000 a year, and his duties are confined almost exclusively to quarantine. The Texas border is a very extensive one, and the Rio Grande is a long, shallow stream. It would astonish this body to know that in the republic of Mexico we probably have ten cases of small-pox where there is one in the dominion of Canada. (Laughter and applause.) Fortunately on the Rio Grande the population is not very thick; the people, too, are very poor. The Mexican people, too, have this idea among them, that it is their duty to call upon their sick friends and relatives when they have the small-pox,

and that increases the danger to be apprehended. Notwithstanding that fact, the few cases introduced into Texas have been isolated, and the people vaccinated, and we have never had any epidemic of magnitude in the state.

Dr. Cabell, of Richmond, Va.—We have in our state a state board of health in existence, but not in active operation, as a clause was added in a recent legislature providing that the state should be subjected to no expense whatever in regard to the state board of health, which was introduced by a senator from the city of Richmond. The state board of health consists of seven members. We endeavored to impress on the legislature the importance of giving us something with which we could make ourselves valuable to the people. The change of the parties has done very little one way or the other for the state board. In the last few years there has been an interest excited on the part of the people in regard to public health, created in some measure by the fact that I was instrumental in getting the American Public Health Association to come to Richmond. I told them by so doing an interest might be excited in favor of health matters, not only among our population, but among the members of the legislature then in session; and a great deal of interest *was* created. The medical society took it up. They have done a great deal to create and change public opinion. The legislature has been induced to create a State Board of Examination, which I am satisfied will result in a great deal of good. No one can practise medicine unless he is passed by this board. Of course persons in practice before the passage of the law are not affected by it. We have a local board of health in Petersburg, and also in Norfolk, managed by competent officers. We have one in Richmond, and although I am president of it, I think I can safely say that so far as the duties are concerned they are equal to any other in the state. We have created a great deal of interest in the city of Richmond in regard to the subject of health. We have also induced the legislature to pass a compulsory vaccination law. The city of Richmond passed one at my suggestion, and no child now is allowed to go to a public school unless vaccinated. This vaccination is gratuitous, and the expense is borne by the county. It is under the supervision of the supervisors, who employ some medical gentlemen to do the vaccination. It is done in incorporated towns by the authorities. I feel very much cheered by the present outlook, and mean to make renewed efforts on the legislature, which is composed of many new members, and I hope that we shall meet with success.

Dr. Reeves (the President).—In order, Mr. President (Mr. Brooks in the chair), that in this report of returns from the State Board of Health of West Virginia there shall be no vacancy in our transactions for West Virginia, I venture to make you a very brief statement. I was forcibly reminded by Dr. Cabell's remarks concerning the influence of the American Public Health Association in his city, of how much West Virginia owes this association for her standing to-day in sanitation. I assure you, gentlemen, that the State Board of Health of West Virginia is merely an

outgrowth of the influence of this association. A great deal of good has been accomplished. Our people are learning every day something of the value of preventive medicine. In 1881 there was not a health board worthy the name in all the state of West Virginia; now there are local boards of health in every county. There are municipal boards also, and our people are beginning to pay attention to sanitation as a necessary part of the civil government. West Virginia, unlike many of the states, imposes on its board the regulation of medical practice, believing that an incompetent doctor is a nuisance as prejudicial to public health as anything that you can imagine. That part of the service causes a great deal of responsibility and labor to the board. And the constitutionality of the law has been questioned, and the matter has been taken to the circuit court, and from there to the final appellate court, and I am happy to say that a verdict in favor of the constitutionality of the law has been rendered. Of course there are some violations of the law. Unfortunately for us, in all probability for the next three years we cannot look to the present executive of the state as being very warmly in favor of state support for such purposes, yet he has complied with the law; but there is not that zeal in his acts which characterized the acts of his predecessor whom this association made a member. He gave a zealous support to the state board of health, and his last message recommended to the legislature above all other things a liberal support to the state board; and I revere his name for such services. I think that you may safely rely on West Virginia's doing her duty in this matter. My successor, Dr. Harris, of Parkersburg, is a gentleman of ability, zeal, and worth, and I offer you for him his sincere regrets that illness has prevented his presence with you to-day. I say in conclusion, that the report from West Virginia is, I think, hopeful.

Dr. Reeve, of Wisconsin.—I think I can report an increase in the interest of the people in regard to public health. We have made some progress in this direction. During the past year, stimulated by the terrible approach of cholera, a law was enacted by the last legislature giving to the state $30,000,—$15,000 for each of the two years, the legislature being a biennial one. This was to be used as a contingent fund in case cholera appeared. In that law were certain conditional powers given to the board. If cholera appeared, the board were given wide powers. It could promulgate rules, and such rules when promulgated would have the force of law. These rules of course would not be law unless the cholera did appear. Neither could we touch the fund appropriated. We have been fortunately very free from epidemics of any great magnitude during the year, and our work has been largely that of encouraging the organization of local boards of health, and stimulating them to work, and working with them. We believe throughout the whole state there never has been such activity on the part of health boards. Never has there been such a state of readiness of defence against disease as now. As an evidence of the activity of health boards, I may mention that we have had three appearances of small-pox during the

year, and each time it was quickly suppressed. The first case was brought to us by a steamship, the same boat that brought small-pox to us several years ago. The other two cases came directly from Montreal, one before the inspection service was established on the borders. In this case it was brought into a thickly settled township, and unless there had been activity on the part of the health authorities there would have been an epidemic. The township contained a population of about 10,000, closely settled. But prompt measures suppressed it at a cost of a thousand dollars without spreading beyond a few houses in the vicinity. There were eighteen cases and five deaths. The other case appeared after the inspection service was established, and the family that brought it were vaccinated, and their baggage fumigated. There have been several other laws passed giving additional powers;—one of them requires outside ladders and fire-proof elevators, and the other law compels the doors of all public buildings to swing outwards. We have reason to think we have created a good deal of interest among the teachers in the state. In common with many other states there was a law which made it compulsory to provide for the teaching of physiology and hygiene in the public schools, and it is the duty of the board of health to recommend the books. Recently we have had three cases of hydrophobia;—two of them died; one was sick at the time I came from home. So, though we have done nothing very startling, we have been steadily at work, and think we have done something towards the progress of hygiene in the state of Wisconsin.

The President.—Is anybody present from the state of Kansas? A new state board of health has been organized there, and we should be happy to hear from it. If not, the chair will call upon the Canadian provinces.

Dr. Covernton, of Toronto, Canada.—Last year I had the honor to attend a meeting of the state boards of health, at the Ebbitt house, Washington, convened for the purpose of receiving reports from all the states in the Union and the provinces of Canada. I then stated that we had succeeded in establishing 660 local boards of health; that as soon as we returned from St. Louis we wrote for reports of what had been done by these local boards of health in the way of preparation for cholera, if it should make its appearance, a general summary of the answers of which I had then the pleasure of furnishing you. At the time our board was formed the powers given to us were simply advisory, not executive in their character, and therefore we had to content ourselves in a great measure with the work of educating people by holding sanitary conventions, by issuing a large number of health pamphlets and circulars, and invoking the aid of the press. The press responded nobly, and in that way we succeeded in evoking such an amount of interest in the subject, that in the course of two or three years after our first establishment we had the fortune, as I have said, to have a large number of local boards of health established. The report from all these boards was eminently satisfactory. They had been educated to the necessity of giving thorough

attention to the cleanliness of dwellings and the surroundings of barns, to the situation of wells and privies, to proper sewerage and the disposition of sewage, to pure air, pure water, pure food, and proper ventilation. I was not aware that our board would be called upon at this time to present a written report, nor do I think that it is called for, because in the very long and exhaustive paper by Dr. Brice on the epidemic of small-pox in the province of Quebec you have had an opportunity of ascertaining that we have now, by recent legislation, such an amount of executive power given to us, that we are enabled at any time, when the emergency shall arise, to promptly, and, I think his paper this morning demonstrated, to satisfactorily, deal with an epidemic when it threatens to invade our provinces. I may further say, that we have had by a recent order in council still more powers granted to us, so that whenever we find that local boards are not doing the work speedily and efficiently, we have the power of appointing our own health officers to carry out the work that we consider necessary; and the government is so fully impressed with the importance of the subject, that they have not hesitated to give us the amount of money that we required for a chief of staff and six inspectors of trains and steamboats leaving the city of Montreal for our province of Ontario, from the beginning of September, at the rate of nearly three thousand dollars per month; and by this prompt and vigorous action but very few cases of small-pox were carried to the province of Ontario.

Dr. Hingston, of Montreal.—I have listened with interest to the account of work done, as detailed by each state in alphabetical order from Alabama to Wyoming. You must not accuse me of boldness if I state that the province of Quebec has done more—much more—than any of them. (Laughter.) Each of your states has created its own board of health, but our province of Quebec has done more. It has not only created its own boards of health, and organized upwards of 250 boards within two months, but it has created boards of health in some of your states. It has certainly created, or caused the creation of, a board of health in Maine. (Laughter.) It has undoubtedly stimulated the boards of health in New Hampshire, Vermont, and New York, and if Montreal should be unshipped from her moorings and floated to Ohio, Virginia, and Texas, I think, sir, there would be boards of health established there very soon. (Laughter.) The Canadian is a very healthy person. He lives to a very old age, and he could not understand the necessity for health legislation for one so hale and hearty as himself. (Laughter.) A local board has existed in Montreal for several years, but not until two months ago, when this fearful epidemic visited us, was the provincial board first formed, and, as I said this morning, that board has organized 250 local boards. The work of the local and provincial boards has been enormous;—but I told you enough of that this morning. There were two things I omitted to mention at that time. One was a law passed in reference to funerals, compelling them to be private. But another thing of moment—the difficulty of getting magistrates to enforce the law. We

have overcome that. An arrangement is made by which one magistrate, *ad hoc*, has the power of two, and care is taken to select men who are not opposed to sanitary matters. Without that provision for its enforcement our law would be a dead letter.

There is one thing more that suggests itself, and it is this: As the province of Quebec generally (and the city of Montreal especially) has taken every possible means to prevent the spread of epidemics, as it has expended money in proportion to its wealth, and as it has thoroughly organized boards of health, local and provincial, will the time not soon come when that province will be subjected to less troublesome restrictions, as to travel and carriage of freight, than at present exist? Some of the states of your Union have been in much the same position as Canada hitherto. I shall not mention them, because I think it is desirable to forget these nightmares. Yet I am not aware that they have been subjected to anything like the boycotting which has been visited upon Montreal. I quite understand that so long as this epidemic or a portion of it remains, these restrictions will be continued, and wisely, perhaps, for no one can desire that small-pox should be disseminated in the United States. But so soon as the time comes when we are free from this epidemic, and it has almost come, then I hope all restrictions will be removed. But I have nothing to suggest to the authorities here, nor have I any information to give them of which they are not already possessed; and I have been surprised at the precise information possessed by your government as to our doings and our shortcomings. (Applause.)

The President.—That part of the paper which has been read, which contemplates a conference, will be referred to the Executive Committee for any further action.

Then, on motion, the association took a recess until 8 o'clock P.M.

EVENING SESSION.—8 O'CLOCK.

The recess having expired, the President called the association to order.

The various papers having been called, and the writers being absent, the President suggested that if the Committee on Disinfectants were prepared with their report, it might be in order at the present time.

Dr. Rohé.—I have nothing to add to what I said yesterday. I simply submitted the report as the report of the committee, and if any member chooses to discuss it now, it is open to discussion.

Dr. Hunt.—Is not the evening too much taken up?

The President.—No, sir, there is plenty of time. (After a pause.) It has been discovered that the programme can be followed as printed; so the discussion on disinfectants will lie over until to-morrow.

Dr. Rohé.—I hope some definite hour will be fixed.

The President.—There was an order fixing 12 o'clock to-morrow. Dr. Hartwell's paper on "The German System of Physical Education" will now be read. (See page 182.)

The President introduced Gov. Gray, of Indiana, who spoke as follows:

Gov. GRAY.—Ladies and Gentlemen, and Members of the American Public Health Association: I arrived in the city only about three quarters of an hour ago, and had just come out from supper, when my friend, Dr. Gatch, took hold of me and pressed me into this room, into the presence of this splendid assemblage. I can say, ladies and gentlemen, that I am very glad to meet you, and to see you on this occasion. As the chief executive of one of the greatest states of this great republic, I cannot but feel a deep interest in the questions that you have convened here to consider. (Applause.) I know of no questions in which the people of America are more deeply interested than those not only of individual but of public health. It is a notorious fact that the American people pay less attention to their health than perhaps the citizens of any other country on the globe. This country, especially for the last twenty-five or thirty years, has been a rapidly growing one. People have been rushing ahead in all kinds of business and avocations of life, feeling that they did not have time to take care of their health, and would not consider that they had time to die if they were not compelled by an overshadowing power to take it. (Laughter and applause.)

Now I want to say that I do not think there is anybody that knows less about the question than myself. But I will say, if you gentlemen assembled here to-night, and the ladies that are here, can cause the American people to take an interest in health matters, and to consider how to put into practical operation the instruction and advice that this association can give them, you will have accomplished more for the country and for mankind than all the politicians in the world put together. (Great applause.) Without health, without physical strength, no man or woman ever became great in the world. A good digestion moves a person on more rapidly than any advice that his friends can give him. (Laughter and applause.)

Now I did not expect to say so much, but I desire to remark, in conclusion, that I hope your meeting may not only be interesting to you socially, but highly instructive, and that you may all safely reach your several homes in safety, and never have other than reflections of the most pleasant character of your meeting at Washington city, the capital of the greatest republic upon which the sun of God has ever shone. (Great applause.)

The PRESIDENT.—Remarks on Dr. Hartwell's paper are now in order.

Dr. HORSCH.—The paper was an excellent one, and very well illustrated. Physical training certainly promotes general health. I think we ought also to take into consideration the Swedish movement, which was very well executed in some of the schools in Massachusetts under Dio Lewis and various others. It is necessary to move every muscle of our bodies at least once or twice a day. Our ladies, for instance, ought to exercise, and use the Swedish movement. This would bring all the muscles of the body into play. I hope, however, that all the exercises used

by the Prussian army for muscular development will cause that development to be used for some other purpose than in the wars, as has been done for the last forty years.

Dr. Hartwell.—I am obliged to the gentleman for reminding me of one thing. I refer to the mechanical gymnastics which are used for medical purposes in Germany and Sweden. Within a few years there has been devised by Dr. Zanden, of Stockholm, a most complete and extremely ingenious and elegant set of machines, which are of two descriptions. One is that in which the patient is worked upon. Any part of his body may be brought into exercise, or may be subjected to mechanical massage. In the other set of machines the work may be altered from time to time under the guidance of the physician, so that any part which is suffering from paralysis or anything of that kind may be exercised.

I have not seen these machines described in any papers in this country. In London they have been in use for a few years, also in Baden Baden in connection with the finest baths in Europe. They have been introduced there only within the last two or three years. The director of the baths is most enthusiastic as to the results. He says one young lady, who had fatty degeneration of the heart and could scarcely get up stairs, was so improved by the result of the training under him that she was able to dance all night. (Laughter.)

The President.—The next business in order will be the reading of a paper by Dr. O. W. Wight on experiences in disinfecting sewers.

Dr. Wight then read his paper. (See page 105.)

Dr. Raymond, of Brooklyn.—The first reference I remember ever to have seen was in a classic paper relative to the subject of the epidemic of typhoid fever at Croydon in 1875. In this instance per-chloride of iron was used. I have been unable to find any exact description of the methods in which it was used. It is spoken of as having been followed with good results.

The point which has been well brought out by Dr. Wight's paper is one which has come to my own notice recently in an attempt to discover, if possible, the cause of the prevalence of typhoid fever in certain sections of my own city. I have used there, although by no means on so large a scale as Dr. Wight, solution of chloride of lime for the disinfection of small pipe sewers, about twelve inches in diameter. The plan seemed almost impracticable at first. The people used sixty gallons of water daily for each individual, and I calculated that the amount which would flow through a given main would run up in the neighborhood of three or four million gallons of water a day. I found by calculation that long before the solution would reach a point a block distant it would be so diluted that it would be absolutely impossible for it to have the strength deemed necessary. But I thought the attempt should be made, and it certainly could have no injurious effect, and it was possible it might have some beneficial effect. Imagine my surprise, a short time after, to find a communication in one of the daily papers complaining bitterly of the method

of disinfecting sewers, and stating that the house of the complainant was permeated by the odor of the disinfectant; and he considered it an outrage that any one should put into the sewers any substance which should find its way into dwelling-houses. The suggestion which was made by that communication has led to the thorough examination of the drains, and I have no doubt that the experience is the same as that related by Dr. Wight, namely, that there is communication by means of drains through the pipe sewers. It is impossible for us, I think, to inject into our sewers any germicide or disinfectant which shall act in destroying germs of disease. We all know that solutions even of chloride of mercury must be of a given strength in order to be effective. In a city where there are daily used from forty to sixty million gallons of water, it is impossible for us to adopt any general disinfection of the sewers. But I can readily understand how in an epidemic locality, particularly where the sewers are constructed as Dr. Wight has described, this method may be exceedingly valuable; and I am sure, sir, this association is greatly indebted to Dr. Wight and the suggestions his paper has brought out. So far as I know, it is the first attempt of the kind ever made in this country on so large a scale, and I hope it will be followed by others, and that their experience will be communicated to this association in the future.

Dr. Rohé.—I would like to ask at what time of the year the sudden diminution of scarlet fever occurred in both of the instances referred to, and what relation it had to the closing of the schools.

Dr. Wight.—The first disinfection was in the months of August and September, when the schools were closed. The next was in the month of June, when the schools were running. We noticed a very marked diminution of the disease following in the line of our disinfection.

Dr. Cochran, of Alabama.—I would like to ask him, while speaking of killing the fungi growing on the walls of sewers,—I would like to inquire if there was any sanitary advantage in that.

Dr. Wight.—I am not prepared for a biological discussion of that subject. It may not be well settled what sort of fungi grow on the inner walls of sewers. The sewage rises to a certain height on the inner walls of sewers, and then settles, and leaves them to a certain extent saturated with sewage, and different germs which might be in the sewage would take root on the inner wall, and the atmosphere being damp, they would more likely be killed by the fumes of burning sulphur than they would in dry places. It has been supposed by some that the theoretical fungus of typhoid fever plants itself on inner walls of sewers, and grows there as fungus grows in water-closets and slaughter-houses. Perhaps a good many other kinds of microscopical living things pertaining to the vegetable kingdom may be growing there, but I am not prepared to enter on such a biological discussion, as it might not be at all satisfactory to us.

Dr. Rohé.—I would like to ask whether any examination of the sort was made after the sulphur fumigation, and whether it was discovered that the fungus growth there was destroyed by the sulphur.

Dr. Wight.—It would not be quite easy to make microscopical examinations of the inner walls of the sewers to ascertain whether the microscopical fungi were killed or not.

Dr. Hartshorne, of Philadelphia.—I wish to join the gentleman from Brooklyn in acknowledging the value of the observations and experiments of Dr. Wight, and I trust none of us will be prevented from appreciating them by too minute consideration of the theoretical questions concerned. It is right we should give them full value. We must not ignore or depreciate the factors that enter into the production of disease while we are increasing our knowledge of the germicides. What I mean to say is, that the practical results are the main things after all. If Dr. Wight has shown in two seasons that there follows the use of copperas in sewers and the fumigation of sewers with sulphurous acid gas a marked diminution in the amount of diphtheria and scarlet fever in Detroit, I think, as practical men, we should be glad to welcome such results. (Applause.)

Dr. Cochran.—I have not the slightest intention of undervaluing these experiments; but it occurred to me, in connection with a very popular prejudice, that perhaps there was a misunderstanding with regard to the rule that might be applied to these fungi growing on the walls of the sewers, just as there is a popular misapprehension in regard to the growths on the surfaces of foul ponds and foul collections of water. They are scavengers, and therefore important sanitary agents; and however accidentally they might have been killed, and that amount of scavenger work interrupted for a while with the design of doing more work by more thorough scavengering than they were doing, yet incidentally it might leave the impression upon the members that it was desirable to kill these fungus growths on the walls of sewers; and that little mistake, as I consider it to be, was what I was aiming at in the question I asked. I have no doubt that such treatment of foul sewers as was made by Dr. Wight will result in great temporary benefit, and I did not have the slightest intention of making a contrary impression, or of belittling the experiment. We want experiment. We want experiments made on a large scale. We want experiments made under circumstances that may be of use to us in the actual practice of sanitation; and they have a different, and in many respects a very much greater, value than experiments on a small scale in a laboratory.

I was very much interested in the gentleman's paper, and have laid its lessons to heart. I felt as if I was almost entitled to criticise a little; and I would like to ask him if, when some twenty-five or thirty years of age, he did not engage in literature, not, I hope, on "a little oatmeal," and translate a certain French work. It was an O. W. Wight at any rate, and it led me to use time in the study of that brilliant Frenchman Cousin that might have been devoted to more profitable uses.

Dr. Wight.—I acknowledge having been twenty-five years of age (laughter), and I cultivated literature, not "on a little oatmeal," but "on a little oat straw" (to quote Virgil correctly), and I own up to the transla-

tion. Literature has been a pastime with me all my life, and I continue it yet. My name is on the title-page of more than forty volumes of books, written, translated, and edited. I wrote a little book on sanitary matters last summer.

Dr. Cochran.—Which I read with a great deal of pleasure.

Dr. Wight.—While owning up to the accusations of my good brother, I want to say a word in regard to this question of microscopic growth. I am going to utter a theory now for what it is worth. I have no doubt in my mind that among the infinite number of things that live about ponds and lakes and in marshes, both animal and vegetable, some of which are so minute that they have never been discovered with our best microscopes,—I have no doubt that a great majority of them, most of them, perhaps, are entirely innocent; many of them are doing a needful work in the universe. Some of them are valuable scavengers, yet it is hard to discriminate between the poisonous and innocent ones; and if we sometimes kill the innocent in fighting the poisonous ones—well, it is the fate of innocence throughout the universe. I have no doubt, as said by Dr. Roberts, the president of the British Medical Association, if I remember aright, in 1778, and who read the most remarkable address probably ever delivered in that great body of scientific men,—I have no doubt, as he intimates, that the poisonous things, especially the poisonous plants, are variations of the innocent. In my own mind I can conceive that the cholera bacillus, which is so deadly, so destructive, diffusing itself around the world, slaughtering its hundreds of thousands of human beings, I can conceive that it is a variation of some innocent saprophite that becomes poisonous through "sporting," the Darwinian variation, causing destruction to life and injury to health. I have no doubt in my own mind that the yellow fever germ is a variation of something originally innocent in the West Indies, which becomes poisonous as a sport of nature, poisonous as the bitter almond is poisonous in its variation from the sweet almond, and for a season becomes destructive among mankind as a parasite.

That is a good deal more of a biological theory than I intended to get off. In Dr. Cochran's very nice point of criticism, which I think is well meant, and I thank him for it as a point of criticism well put, and while thanking him for it, I must say again that we can not discriminate in our work of destroying poisonous parasites. We cannot discriminate between them and the innocent ones that may do good work in the world. I would not refrain from destroying cholera germs, because we might possibly destroy some innocent germs. (Applause.) I would not refrain from killing poisonous germs in a sewer because we might destroy some innocent fungus growth that might perhaps do some good work of scavengering.

I acknowledge two or three experiments are not sufficient for scientific deduction, but I know that deadly disease ceased right along the route where we were working, and since the first fumigation of bad sewers in that town diphtheria has never resumed the hold it had before.

(Applause.) I intend as long as I remain there to insist upon it every summer that these sewers shall be disinfected, not only with copperas, but also with the fumes of burning sulphur. I believe in giving such dirty sewers hell. (Laughter and applause.)

Dr. ROHÉ.—There is a suggestion I would like to make. Dr. Wight has evidently the confidence of the government of the city of Detroit. He has made two successful experiments in summer-time. I hope that he will repeat them in winter the next time while the schools are in session. He fumigated sewers the first time in summer when the schools were closed, and the second time in summer just before the schools closed, and there was a diminution of the disease as there always is in summer. I hope that with the means he has now at his disposal, having the confidence of the city government, being able to do a great deal more than elsewhere,—I hope he will perform the same experiments in winter, in January or February, before the schools close, before the warm weather comes on and the houses are ventilated in the natural way, and let the association know at the next meeting the result of that experiment.

Mr. ———.—Do not put me down as a doctor; I am only a plumber. (Applause.) I believe this is the first time I ever heard of a plumber being applauded in public. (Laughter and applause.) But I would like to say a word on Dr. Wight's paper. It naturally relates to my line of business more than the average papers that come before this association, although in all its work I have felt a hearty interest. I believe the question of drainage, sewerage, and ventilation is a good deal more important than a great many physicians are inclined to think. Indeed, I am sometimes afraid if the doctors were to lose the ability to refer to sewer gas as a cause of disease they would have to look up something new. (Laughter.) Now it is told of a physician in Cleveland that when he goes into a sick-room that smells of the odors pertaining to such a room that he does not quite understand, he looks wise, and says, "Sewer gas! Can you not smell it?" And it is possible that it is responsible for a great many of the evils laid at its doors, and it is also possible that it is used to make a bigger scare than is necessary. I believe that the experiments of Dr. Wight, whether valuable in a direct line or not, are exceedingly valuable in showing the very bad sewer connections that are made, not alone in the city of Detroit, but in every other city in the country; and what I want to say directly is, that plumbing and sewerage ought to come under the boards of health and the health authorities of the states and cities. (Applause.) Having been upon the board of health of Cleveland for five years, I have tried, without a great deal of success, to accomplish something in that direction. I understand that the city of Washington does better in this direction; that all the plans of new buildings are submitted to the inspector appointed by the health department, or under its control, who not only approves the plans of sewers and plumbing as it thinks may be proper or improper, but has the power of inspection. I believe this inspection system is a most valuable one in

any city whose water-supply has to be depended on by thousands for daily use. (Applause.)

In Cleveland we suffer a great deal from the open ends of great sewers. I have been attempting to obtain perforated man-holes for the straight sewers, and I believe it to be a most valuable thing. You would not have any concentration or accumulation of sewer gas under those circumstances. It would be given off at the surface of the sewer just as rapidly as formed, and diffused instantly in the atmosphere. I am not afraid of any sewer gas that escapes into the air. It is diluted by the atmosphere, and is, in my opinion, harmless,—I mean sewer gas. Whether germs of disease contained in that might be harmless I am unable to say, but the method I refer to would relieve sewers of all compression which is made, and it is applicable to any system of sewers, and would cost nothing except the throwing away of the old man-hole covers. Excuse me for encroaching on your time. (Applause.)

Col. Waring, of Rhode Island.—While it may very well happen, and no doubt does frequently happen, that active measures of disinfection in straight sewers are necessary, and that the methods adopted by Dr. Wight are best, there is one incidental effect of that work which we ought to bear in mind, and which, of course, ought not to be pushed to extremes. I refer to the extremely pernicious action of the fumes of sulphur on cast iron, and the danger that defective soil-pipes may be made more defective, and so much so as to be valueless and dangerous. This is a condition that we ought always to consider. If there is any other means by which the same end can be accomplished, and this danger to iron soil-pipes not result, we ought to know what it is, and use it in place of the method described.

Dr. Wight.—Sulphur fumes wont hurt bricks and glazed pipes.

Mr. Robinson.—One good accomplished by the experiments made by Dr. Wight in Detroit has been to determine the fact that there are defective terra cotta drains in the houses. The pernicious effect of having such drains we all know about, it having been discovered by personal inspection that two thirds of the terra cotta drains under houses were defective. The sulphurous acid gas passing from the pipe sewers into the house drain would establish the fact that there were broken joints. I only wish to call attention to the fact that great good was accomplished by making the experiment, and determining that there were defects in the drainage system of the houses.

A Member.—There is a very important meeting to be held to-night, and if it would not throw over some of these papers, I suggest that Dr. Lee's paper be fixed for the morning.

The President.—The programme is already fixed and cannot now be changed, and the next paper in order will be "The Debit and Credit Account of the Plymouth Epidemic," by Dr. Lee.

Dr. Lee, of Pennsylvania.—You will understand, gentlemen, that I am perhaps not in the best possible condition for appearing before you, when I tell you that I was badgered for an hour and a half upon the

stand this morning by the ugliest bull-dog of a lawyer that ever took hold of a poor doctor, and that I have travelled on the way ever since, and I hope that you will make due allowance. (See page 283.)

Dr. McCormack.—I wish to ask Dr. Lee if anybody believes that that epidemic was caused by that one sick lady?

Col. Waring.—Perhaps I can throw some light on the value of the results to be obtained as Dr. Lee has described. I had occasion to appear before the Appropriation Committee of the house of representatives, backed, as I thought, with good letters of introduction to advocate the cause of the National Board of Health. The chairman looked at me a moment, and said, "H'm! that is not our business; and besides, if we appropriate money to support the board of health, it will not be long before every city in the country will want a board of health." That is all the consideration I was able to get.

Then, on motion, the association adjourned until 9:30 A. M., December 10, 1885.

THIRD DAY.

Thursday, December 10, 1885.

MORNING SESSION.—9:30 O'CLOCK.

The hour of 9:30 o'clock having arrived, the association was called to order by the President.

The President.—The first thing in order is the announcement of the chairman of the Committee of Arrangements.

Dr. Townshend.—I am authorized to state that the President of the United States will receive the members of the association in a body at 3 o'clock this evening. The committee, however, have refrained from making any arrangements of any kind for to-morrow. Our time will be very much occupied, and it will not be possible to make any preparations. The committee have not thought it will be proper to prepare any entertainment for to-morrow. However, we have gotten up a kind of rough and ready oyster roast, that will come off to-morrow at 2 o'clock, after the association adjourns. The roast will be at the oyster wharf, which can be reached by the street railroads. Tickets will be furnished to the members at the Secretary's office. I will state also that the committee have made no arrangements about inviting members of congress other than those first thought of. The committee think it would be best for each member of the association to take the trouble to invite each his own representative in congress, and accompany him to the oyster roast. It will not be necessary to tell the members where to go, or how. They understand all that. They have been there before. So I wish each one of you would take the pains and trouble to see that your representative in congress receives an invitation. Invite them to accompany you or go themselves to be entertained at the oyster roast. I may add that there will be plenty of good oysters. They will be roasted right before your

eyes. This will be a sight for some of you, who have never seen anything like it before. There will be plenty of good cold water there to keep you in condition.

The PRESIDENT.—The Secretary will now report the work of the Executive Committee.

The SECRETARY.—The following named persons are recommended for membership. (Names in list.)

On motion, the Secretary was instructed to cast the ballot of the association for the persons whose names were read, and they were declared to be members of the association.

The SECRETARY.—The Executive Committee report as follows on the resolution offered by Dr. Chancellor in reference to a sanitary conference, that it is inexpedient to adopt the resolution.

The following resolutions have been transmitted to the association from the board of health of Philadelphia, Pa.:

WHEREAS, The importation of old rags into the United States has been the means of introducing small-pox and other contagious diseases; therefore be it

Resolved, By the board of health of the city and port of Philadelphia, that hereafter no rags from foreign ports shall be permitted to land at the port of Philadelphia until they shall have been disinfected to the entire satisfaction of this board, either at this port or at the port from whence shipped.

Resolved, That the members of the American Public Health Association from Pennsylvania, now about to convene in Washington, be requested to urge upon the association the necessity of passing judgment upon the matter of the importation of rags, and that this board respectfully asks the association to recommend the thorough disinfection of imported rags in every port of the United States before they are distributed for manufacturing purposes.

Resolved, That the chief clerk be directed to forward a copy of these resolutions to the President of the American Public Health Association, attested by the seal of the board.

The Executive Committee recommend that these resolutions be referred to a special committee of five for consideration and recommendation.

Dr. GIHON.—I move that the committee called for by the resolutions just read, be appointed by the President.

The motion of Dr. Gihon was put and carried.

The SECRETARY.—On the resolutions presented to the association yesterday by Mr. Lomb, the Executive Committee report the same in a new draft, as follows:

Resolved, That the American Public Health Association respectfully recommend to the Commissioner of Statistics and Labor the appointment of one or more commissions of experts, whose duty it shall be to visit the principal factories and workshops in this country, to examine them carefully with reference to the provisions made in them to ensure the safety and health of the employés, and to report on the same with recommendations.

On motion, the resolution was adopted.

The SECRETARY.—I desire to make the following announcement: Six hundred tickets have been presented to the association by Mr. Henry Heath, president of the Washington & Georgetown Railroad Company, for the use of the members of the association on said road.

The Treasurer of the association is located in room 6. All members of the association who have not paid their dues are requested to do so.

The PRESIDENT.—I appoint Dr. Wight, Dr. Bailey, and Dr. Wood on the Auditing Committee of the Treasurer.

The report of the Auditing Committee was here read, and, on motion, adopted.

The PRESIDENT.—I call your attention to the fact that the Advisory Council will meet in this room immediately after the adjournment of this session.

Dr. QUIMBY.—I suggested a resolution here night before last. I see the Executive Committee have not acted upon it. I think my resolution should pass, or something be done with it. The object of the resolution is to obtain aid for the association. We want an appropriation of $25,000 annually.

Dr. TOWNSHEND.—It seems to me that those resolutions are not open for discussion.

Dr. GIHON.—This whole subject has been referred to the Advisory Council. They will embody all the resolutions in one. The Advisory Council proposes to make a compact resolution, and present it to the association for action.

Dr. RAYMOND.—I would like to offer this resolution:

Resolved, That the subject of the disinfection of sewers be referred to a special committee, of which Dr. Sternberg shall be chairman, to report on its practicability at the next meeting of the association.

On motion, the resolution offered by Dr. Raymond was adopted.

Dr. GIHON.—Before we begin the regular order, I would like to make a few remarks. The chairman of the local committee has notified you that the President will receive the association at 3 o'clock. Now let me call your attention to one thing. In the line of places of interest in this programme, you will find the Museum of Hygiene. Now I doubt whether the members of the association know what a splendid institution this is, and I hope that after the visit to the President, those of you who have not been there will find it convenient to pass half an hour or so there. The building is on the corner of 18th and G streets.

The PRESIDENT.—I beg to remind you and every member of the association not to go there at that time, because we will have to come back immediately to finish up our business.

The paper on "Maritime Quarantine from the Mouth of the St. Lawrence to the Rio Grande," by Dr. H. Rauch, was next in order, and was read. (See page 125.)

During the reading of Dr. Rauch's paper,—

The PRESIDENT said.—If Dr. Holt has any report to make in regard to Louisiana quarantine, it is now in order.

Dr. HOLT.—The detail plan and specifications, as made by Dr. Rauch in his able report on quarantine stations of the United States, contains essentially all that I here wish to say in regard to this matter. There is

nothing I can add, and it will be taking up your time, and detracting from his time in the reading of his paper. There are several gentlemen attending this meeting of the association who have to deal with these questions in their practical application, and I shall endeavor to make it a point with them, and such others as may be pleased to attend, to have an informal conversational meeting to discuss the whole question in its practical application and bearing. To discuss the question before a large audience, many of whom are from the interior, and perhaps have no special interest in the details of this question of maritime sanitation to protect our country from the inroads of pestilence, would be rather wearisome, and I will not take up your time.

Dr. Rauch then resumed, and concluded the reading of his paper.

Dr. Covernton, chairman of Ontario Board of Health.—About four weeks ago, at the time of the quarterly meeting of our board, a motion was carried having for its object the establishment of an international quarantine, under the operations of which it was hoped that the spread of infectious diseases would be prevented or controlled. But, sir, a recent report of the English medical officer of the local government board of health, Dr. Blaxall, shows that it is absolutely necessary for us to depend on ourselves, and not on the protection and precautions that are being taken at European ports. Not from the absence of a sufficient amount of legislation—there is an abundance of legislation to cover the whole question; but, unfortunately, that legislation in a large number of instances is not acted upon.

While Dr. Rauch was delivering his lecture, I jotted down a few points I recollected reading in the report of Dr. Blaxall. He states that among the mass of immigrants there are a large number of Germans, Hungarians, Poles, Danes, Swedes, Norwegians, Laps, Fins, and Jews, who cross in summer, in small vessels, from various continental ports, either to the ports of Liverpool, Bristol, Hull, or Leith in Scotland, or to the various ports in Ireland, from thence to take ship to this country; and the description he gives of the vessels that are employed to carry these immigrants indicates that it is absolutely necessary for us not to depend on anything that is done over there, because comparatively little is done. He says that frequently there are such a number of these immigrants crowded in the steerage that there is not air space of 150 cubic feet per head. He further states that he was informed that vessels were being built that would supply 300 cubic feet per head, but up to that time they were not in operation. Then, in addition to that, it is not required that these immigrants should produce certificates of vaccination, nor during the time that elapsed between their arrival at these British ports and embarking for America, was there the requisite investigation into freedom from infection.

Dr. Bailhache.—I desire to raise a point of order. I believe no discussion is to take place until after a group of papers is read.

The President.—The point is well taken.

Dr. Lee, of Pennsylvania.—I do not wish to discuss the question, but

there is one port in Pennsylvania that was not touched upon in the report. The health officer of that port is present. Would it not be in order for him at this time to state the measures which have been taken there during the past summer, as supplementary to this report?

The PRESIDENT.—The Chair thinks nothing is in order at the present time but the hearing of prepared papers on kindred subjects, and then, when they are read, discussion will be in order on the subjects.

Dr. HOLT.—I wish to make a request. In order to avoid wearying the association with an exhibition of the detailed plans and specifications of maritime sanitation, and inasmuch as there are several gentlemen here from our great sea-coast line who are earnestly interested in this question, I would propose that these gentlemen, together with all members of the association who will be pleased to honor us with their presence, meet this evening at 6 o'clock, in Room No. 6 of this building, the room which was occupied last night by the conference of the state boards of health. I propose this in order that we may, in a conversational way, traverse this entire question free from the restraint which would be necessary in discussing it in a place like this.

The PRESIDENT.—The next paper in order is that on "Sanitary Protection of New Orleans, Municipal and Maritime," by Dr. Joseph Holt. (See page 89.)

The PRESIDENT.—This paper, under the rules, must be referred to the Executive Committee. I will state, however, that the subjects embodied in these resolutions are before that committee and the Advisory Council also. The next business in order is the reading of a paper on "Maritime Sanitation," by S. T. Armstrong.

A MEMBER.—Was there not a special order for 12 o'clock?

The PRESIDENT.—I desire to make an announcement on behalf of the local committee, as there are many members now present who were not here when the announcement was made, that it is the purpose of the local committee to take the members of this association to the executive mansion upon the appointment of the President of the United States, at 3 o'clock this evening. I wish to announce also that the Advisory Council will meet immediately after the adjournment of the morning session in this room. The meeting is a very important one. In regard to the special order, the Chair, in justice to the order of exercises, thinks that the papers should first be read, and therefore Dr. Armstrong will proceed. (See page 98.)

Dr. HARTSHORNE, of Philadelphia.—In listening to Dr. Rauch, I was inclined to note one point, incidentally referred to as marking a progress made in public sentiment, of interest especially to those members of the association who look back to similar discussions some ten or a dozen years ago. The remark I refer to is that in which he speaks of the detention of vessels for ten days. A simple detention, if I understood him, makes the vessel no better, but often more dangerous than before; and what is true of ten days in a warm climate, I believe to be true of twenty, thirty, or sixty days. In the paper of Dr. Holt, the progress of opinion

seems to have taken shape more positively and with some distinctness, and we have maritime sanitation proposed as a substitute for quarantine. Quarantine is a word of mediæval origin, and presents almost a mediæval idea. Maritime sanitation corresponds with the present progressive condition of sanitary science. I wish to emphasize this. If this association could fully comprehend and adopt this phrase, and the exposition given to it by Dr. Holt, and the exemplification of the successful protection of New Orleans from epidemics and contagious diseases, it will mark an era in sanitary science, one of the most important for many years. (Applause.)

Dr. W. M. Smith, of New York.—This method of which Dr. Holt has so pleasantly spoken, and which he has so graphically described, has been pursued at New York quarantine for quite a number of years. The quarantine there has been a quarantine of measures, and not a quarantine of time. It ought not to be called quarantine, if we undertake to convey by that term its original meaning. It has been a quarantine of sanitation. The principle proposed has been acted upon, that what is killed will not live; that it will not be resurrected; that if it is a germ that is the cause of infection, if it is destroyed it will no longer be dangerous. Therefore, a ship considered infected is discharged and cleansed, and it is simply a question of time how quickly that can be done. If it can be done in twenty-four hours, it is done, and she is sent to her dock. Commerce has been but very little affected in consequence of the methods pursued at New York. The burden has been lifted to a great extent. I have been surprised—I have long been surprised—that our Southern communities—the seaport towns—have not pursued this method earlier than they have. I think Dr. Holt is right, entirely right, and that in consequence there will be a resurrection of the commerce at Southern ports during the yellow fever season.

Dr. Bell.—I hardly need say that I was gratified with all three of the papers read to us this morning, marking a progress that I have been trying to have carried out for a little more than twenty-five years, if I take as a starting-point some measures referred to by my friend, Dr. Hartshorne, of which he knows the history very well. The phrase "fighting time by measures," together with what Dr. Smith has said, if we did not attempt to qualify it, would lead to a false impression. We have been fighting time. We have written laws—quarantine regulations—designating that within twenty-four hours from the time of arrival at New York quarantine, such and such measures shall be undertaken. I have not seen the whole length of coast, as marked out by Dr. Rauch so well, but I have seen from Alabama to New England something of what may be called fumigating and disinfecting ships—trying to do that which, until recently, has not been done, either from negligence or ignorance, or both in a measure, I believe, viz., the formality of disinfecting has been gone through with when the ship is plugged up as tight as possible. To try to disinfect a ship by burning sulphur in the hold is one of the greatest absurdities that a man of sense ever undertook. (Applause.) Why,

we might as well undertake to drive sulphurous gas into the cellar of this hotel by burning a pot full in this room. But, if I understand Dr. Holt, the first process is exposure. If you do not open up the bilge so as to let these fumes of gas go through the hiding-places where the germ is retained, not for forty days, but for forty years, you will have a floating death-messenger going from one port to another throughout the world.

Now we have heard a great deal about what is dangerous to carry. One of the most dangerous articles we now have to contend with is rags. That has been well discussed: but in my opinion the ship that brings them is still more dangerous. I hope to live to see the day when there will be a law passed to prevent a man, by the payment of a few dollars, withdrawing his ship from quarantine. The persons who deal in these dangerous materials thus can say, "If you do not let us in, we will go to your neighbor, and send the goods through the back door throughout the country." You cannot treat with such people. As well treat with a cut-throat who comes to your room at night, and give him a few dollars, and tell him to go across the hall and kill the man there.

Dr. JAMES.—This paper of Dr. Rauch's seems to me to have covered just one side of the country. I would like to see this subject continued next year, taking the western side of the country from the Rio Grande, and have a series of inspections such as have been gone through with during the past year, and have him report on that next year. It seems to me we ought to have the statistics pointed out on the western coast. I think this is one of the most valuable papers that have been presented, picking out impartially the different localities, and pointing out the modes already introduced, and showing where the imperfections are in the various ports. It is also valuable because it bears directly upon the points we want to know about in keeping away from our borders these infectious diseases. Of course the commercial interests will be affected to a certain extent, but I think it is our duty as sanitarians to point out defects wherever we see them, and then suggest to the proper authorities the methods by which the defects may be remedied.

I am not opposed to the name of quarantine, although it is an old name, and I have no objection to a new name, if suitable; but I think we ought to show to other nations that we will not allow any infectious disease to go from our ports, either in the way of persons or material. I never heard of vessels being examined before leaving our ports. We do not do it in Philadelphia or New York. I think our national government ought to give us a law to protect us in this way.

Dr. BELL.—The very service to which Dr. James refers was instituted in New Orleans, Louisiana, in 1879, and kept the yellow fever from spreading. The measures which were then adopted were written out twenty-five years ago.

Dr. JAMES.—I would like to see them enforced by a national law.

Dr. LEE.—It should not be forgotten in this connection that the United States has a northern maritime border, as well as an eastern and western one. I refer to the great lakes, or inland seas. While it is true we have

quarantine at different points on the St. Lawrence, yet our northern border is liable to exposure from vessels coming from the dominion of Canada. We have one port in the state of Pennsylvania which is liable to such exposure; and in order to complete the report of the quarantine of the Pennsylvania coast, I would move that the health officer of Erie be requested to prepare a brief report of the measures taken in that city during the past summer in order to prevent the introduction of disease into the United States, and that such report be appended to the report of Dr. Rauch.

The PRESIDENT.—The gentleman will reduce his motion to writing.

Dr. QUIMBY.—I desire to say that the paper of Dr. Armstrong is valuable in reference to two points, and especially in reference to the cleansing of the decks. That sometimes leads to more mischief than good, because they are oftentimes made wet without removing the dirt. There is another thing in reference to the bilge water that is important. The water should be pumped out thoroughly, and disinfected with a bichlorate solution, thus rendering the vessel more habitable.

I think that our friend Bell made one statement a little too strong, and that is when he said that the ship was almost as dangerous as the rags. I think that is too strong, as the rags go everywhere and are handled by a good many people, while the ship goes only to the port. I do not think the ship is as dangerous as the rags.

Dr. LEE.—Is that subject of the disinfection of rags properly before us?

The PRESIDENT.—No, sir.

Dr. LEE.—Whenever it is, I should like to offer a resolution.

The PRESIDENT.—The time is growing late, and I hope the association will remember, if they have nothing particularly striking to say, that we have got to go to the President's at 3 o'clock.

Dr. THOMPSON.—I move we take a recess.

Dr. QUIMBY.—Before adjourning, I would like to ask a question.

Dr. THOMPSON, of Kentucky.—The motion is not debatable.

Dr. QUIMBY.—I hope the gentleman will have a little patience. I simply desire to ask a question for information. I desire to ask whether we go from here to the President's or not.

The PRESIDENT.—We will meet here.

The question was then taken on the motion to take a recess, and it was carried, and the associationa ccordingly took a recess until 8 o'clock P.M.

EVENING SESSION.—8 O'CLOCK.

The recess having expired, the meeting was called to order by the president.

Dr. TONER.—I desire to make a statement which will take only about three minutes. There appeared in some of the morning papers to-day some statements relative to the frequency of consumption in the district. I do not know whether the remarks were correctly reported or not. I am not inclined to speak on that part of it. But in assigning the reasons of the large mortality from consumption in the district there was one

main factor left out to which I wish simply to call attention, and that is, the large colored population of our city, being one third of the population, and the fact that the colored race suffers very much from that disease.

Another point: Our city is a sort of centre between the North and South, and many persons in the last stages of consumption reach this point and die, and the deaths are recorded as deaths in the district. I would request that this explanation might be permitted to be placed by the side of the other statement.

The President.—If there be no objection to Dr. Toner's explanation, it will go on record without discussion or further motion. The Chair hearing no objection, it is so ordered. The Chair will appoint Committee on Disinfection of Rags, Dr. Taylor of Philadelphia, Dr. Bell of New York, Dr. Baker of Michigan, Dr. Chancellor of Maryland, and Dr. Horlbeck of South Carolina.

The next business is the report of the Special Committee on the Lomb prizes. If the chairmen of the committees are present they will please come forward on the platform and make their announcement.

The first report will be from Dr. Chancellor, of Maryland, on "Healthy Homes and Foods for the Working Classes."

Your committee has carefully examined the thirty-six essays on "Healthy Homes and Foods for the Working Classes," submitted for the Lomb prize, and does not find that any of them fulfil the terms of the announcement.

In view of the fact that the essay bearing the motto, "He who secures a healthy home and healthy food for himself and family does not live in vain," is one of great merit, your committee has decided to award to it the second prize.

C. W. CHANCELLOR, *Chairman.*
CH. SMART, *Major and Surgeon, U. S. A.*
ALBERT L. GIHON, *Medical Director, U. S. N.*
J. H. RAYMOND, *Secretary.*

The President.—The Secretary will now break the seal of the proper envelope containing the motto indicated in Dr. Chancellor's report.

The Secretary announced that the envelope contained the name of Victor C. Vaughan, of Ann Arbor, Michigan.

The President.—Mr. Brooks will present his report on the next class, "The Sanitary Conditions and Necessities of School-Houses and School Life."

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After careful examination of the papers, your committee do not feel at liberty to award the highest prize to any one of the writers, and have come to this conclusion, because, in their judgment, no one of them, on the claim of originality, new investigations, or superior merit, is entitled to it.

The prize of $200 is awarded to the author of the paper bearing the motto, "*Da veniam pueris*," as being the best and most complete paper on the subject of school hygiene.

(Signed) ERASTUS BROOKS, *Chairman.*
GRANVILLE P. CONN.
H. P. WALCOTT.
GEORGE E. WARING, Jr., C. E.
JOHN EATON.

The PRESIDENT.—The Secretary will now break the seal of the proper envelope containing the motto indicated in Mr. Brooks's report.

The Secretary announced that the envelope contained the name of D. F. Lincoln, Boston, Mass.

The PRESIDENT.—Dr. Durgin will announce his report on the next class, on "Disinfection and Individual Prophylaxis against Infectious Disease."

Your committee, to whom was referred the essays upon "Disinfection and Individual Prophylaxis against Infectious Diseases," have attended to their duty, and beg to make the following report:

Nine essays were submitted, and have been examined with due care. One of these, bearing the motto "*Ad astra per aspera*," possesses a very high order of merit, not only in its completeness, but in its freedom from extraneous matter.

Your committee unanimously recommend for this essay a first prize. Several of the remaining essays possess differing degrees of merit, but none of them in such degree as in the judgment of your committee to warrant the recommendation of a second prize.

S. H. DURGIN,
J. A. REEVES,
J. L. CABELL,
J. H. McCORMACK,
GUS. DEVRON,
Committee.

The PRESIDENT.—The Secretary will now break the seal of the proper envelope containing the motto indicated in Dr. Durgin's report.

The Secretary announced that the envelope contained the name of George M. Sternberg.

The PRESIDENT.—Dr. Hunt will present his report on the next class, the "Preventable Causes of Disease, Injury, and Death in American Manufactories and Workshops, and the best Means and Appliances for Preventing and Avoiding Them."

Subject No. 4, upon which your Committee on Prizes was directed to act was as follows: "The Preventable Causes of Disease, Injury, and Death in American Manufactories and Workshops, and the best Means and Appliances for Preventing and Avoiding Them." Three essays were presented. Your committee makes no award of a first prize. The second prize was directed to be awarded to the essay bearing the motto "Preston." The committee resolved that the essay with the motto "Mechanician" be recommended to the association as worthy of publication by the association, with the author's permission. The committee also recognizes the essay with the motto "Carlfried" as a paper of ability and great usefulness, but not entitled to a prize, because so largely made up of references and of the statement of existing evils, and so not conforming enough to the terms stated in the title and the circular accompanying it.

By order of the committee.

EZRA M. HUNT, *Chairman.*
W. P. DUNWOODY, *Secretary.*

The PRESIDENT.—The Secretary will now break the seal of the proper envelope containing the motto indicated in the report.

The Secretary announced that the envelope contained the name of George H. Ireland, Springfield, Mass.

The PRESIDENT.—Gentlemen of the Association, you have now heard

the responses to the Lomb prizes. I am proud to tell you that not only in this great country of ours was there a large number of competitors for these prizes, but that your name was known abroad, and there came contributions from foreign countries; but unfortunately for the authors, they did not comply with the terms of the advertisement, and were printed in a foreign language, and could not compete with the American productions.

I now, ladies and gentlemen, have the honor of presenting to you a gentleman who out of his comparatively small means has done a good work for 60,000,000 of our countrymen. My friends, Mr. Henry Lomb, of Rochester, N. Y. (Applause.)

Dr. Billings.—Mr. President, among the various functions and duties of this association there is one which has not been exercised because there has never been any occasion to exercise it heretofore, viz., the bestowing of a signal and special mark of approval upon a man who has done something worthy of such a mark in behalf of the health of the people. I think the time has come for this association to take that action.

I do not propose to detain the meeting by any remarks upon the value and the importance of the subjects selected for these essays, nor upon the probable good which will result in any way from this competition; but I propose that this association shall compliment the gentleman who has shown such sound, practical sense, such wise discretion, and such liberality, in not only the amount, but the method and manner, of his gift.

I therefore move that Mr. Lomb be made a life-member of the American Public Health Association. (Applause.)

The President.—All in favor of that motion will please rise.

The question was put, and decided unanimously in the affirmative by a rising vote.

On motion of Dr. Toner, the authors of the various successful papers were invited on the stand.

The President.—It is the wish of Mr. Lomb that the sum of money unexpended for the noble purpose for which it was set apart shall be continued for the next year, to be used for similar prizes on similar subfects, with such modifications of title as the Executive Committee in its wisdom may see proper to make. (Applause.)

Dr. Thompson.—Mr. President, just one minute. These essays are of such importance that it occurs to me they should have wide publicity; and I rise to move that the state boards be allowed to publish them, and distribute them among our people.

The President.—I will say to the association that the subject is already before the proper committee to see if some method cannot be adopted to accomplish the object the gentleman has spoken of.

Dr. Thompson.—If that be so, I will not make any further motion.

The President.—The next business in order will be the report of the Committee on School Hygiene, by Prof. D. A. Sargent.

Prof. Sargent.—The report will be brief; and I believe that the sum-

mary that has already been presented on this subject will not necessitate any extended remarks by me, and I may well lay the report on the table. There are several of the committee present, however, and I trust that they may have an opportunity to touch upon any topic or subject that has not already been touched upon in this summary. (See Reports of Committees.)

Prof. SARGENT.—(After the reading of the paper.) The committee feel that in order to get any reliable data they must obtain them through their personal observations; and they would therefore suggest that the committee be enlarged, and inasmuch as it is simply a committee for the collection of data and not an executive committee, I do not know why that committee could not possibly be extended to the members,—a member from each state,—and in that way we could get some reliable data. As it is now, each member of the committee simply gives individual experience. I feel that it is not a representative report, and therefore that the enlargement of the committee is very much desired. (Applause.)

Dr. HUNT.—In accordance with suggestion, I desire to ask the reference to the Executive Committee of the following resolutions:

Resolved, That in the opinion of this association the time has come when some system of practical teaching in hygiene should be introduced in the schools and colleges of America.

Resolved, That the Committee on Physical Education be continued, with authority to add to its numbers from members of the association in sections of the country in which they desire to secure accurate facts and statistics.

The PRESIDENT.—The next business in order is the report of the Committee on Animal Disease and Animal Foods, by J. M. Partridge. (After a pause.) Professor Partridge not being present, the next paper in order will be the report of the Committee on the Disposal of the Dead, by Dr. John Morris.

Dr. MORRIS.—I would rather have my paper published. There are not many people present, and those who are seem to be growing impatient.

The PRESIDENT.—You had better read the paper, Doctor.

Dr. MORRIS.—Well, if you can stand it, I presume I can. (Laughter.) (See page 78.)

Dr. HARTSHORNE.—In regard to the communication of disease by dead bodies, am I right in understanding that the evidence shows that there is such contagion?

Dr. MORRIS.—The literature I gave in that report, I gave for the year. I did not go back, because it is asserted that it is not trustworthy.

Dr. ROHÉ.—I know of no trustworthy evidence in regard to communication of disease from cemeteries, and I would like to ask, Has not disease been traced to the water of the well to which you refer in that paper?

Dr. STEUART.—Allow me to say that there were two cases of typhoid fever reported from the neighborhood, which attracted my attention.

A MEMBER.—Do you think they were due to this water?

Dr. Steuart.—I had sufficient reason to think so.

Dr. Kedzie.—I can give no information in regard to facts during the present year, but some years ago—some six or seven years ago—there was a fearful epidemic in the city of Grand Rapids. My attention was called to the matter, and on examining the ground where the outbreak occurred, it was found to be at the bottom of a steep incline, right at the foot of a cemetery. They had dug wells down there, and the whole drainage came down from the cemetery. The families who lived in the infected district drank of this water. There were about fourteen families. I sent to the doctor who sent me the report of the cases, asking him to send me a specimen of the water, but it was never furnished. I afterwards examined the contour of the lands in this cemetery, and traced the whole seapage of the water into the wells.

Dr. Rohé.—I feel, Mr. President, that I am obliged to say a few words in my own defence. I have said that there was no trustworthy evidence known to me in regard to the communication of diseases in the way referred to, viz., that infectious diseases had been transmitted from cemeteries. I have not yet had that evidence presented to me. The evidence presented by Dr. Kedzie does not seem to me clearly to establish the fact at all. It remains to be seen whether there was, before the first outbreak at the foot of the cemeteries, within two weeks or months after a burial, any case of typhoid fever at that place. It remains further to be seen whether there was any outbreak in the place, and any matter thrown into cesspools that could drain into the wells where these people got their water. The spring that has been mentioned by Drs. Morris and Steuart, at Greenmount, is not very far from the gate-keeper's house at the cemetery, and the gate-keeper's house is not far from the cesspool attached to it; and it is just as likely, in my opinion, that the drainage into this well came from the cesspool, or some other house in the neighborhood, as from the cemetery. I am glad that Dr. Morris has given the references he has, because I shall look them up at my earliest convenience. I believe a good deal of testimony is credible, but so far as I have been able to see, and I have studied this subject as thoroughly as possible with the means at my disposal, I have not been satisfied in my own mind that any case of infectious disease has been transmitted from decomposed corpses in cemeteries.

Dr. Horsch.—It seems to me that it is evident that the process of burning bodies is certainly the most effectual way of disposing of the dead, and in the course of time I think it will become universal. It is not only that disease may spread in this way from cemeteries, but in large cities like New York, Washington, and other cities, the room will be needed—the land will be needed.

A Member.—There is one question I should like to ask, whether it is possible in cases of epidemic, such as we have just had in Spain, to make provision for the cremation of that number of bodies.

Dr. Morris.—I think that an epidemic could be provided for.

Dr. Raymond.—Can it be done promptly and immediately?

Dr. Morris.—Yes. It can be by making a funeral pile;—that is the way it is done in case of a great battle. I wish to say, Mr. President, that so far as expense is concerned, it only costs about six or seven francs, and the plea of expense goes for nothing; and so far as the argument about destroying the evidences of crime is concerned, that can be provided for. In Europe they have two men who are required to examine the bodies of the dead.

Dr. Formento, of Louisiana.—Mr. President, I am in favor of cremation as the best method of disposing of the dead in times of epidemic, and at all other times. Last year I offered a resolution, in which I desired this association to express its opinion in favor of cremation, especially in crowded localities, and in times of epidemic and contagious disease. It was this resolution of mine, modified by the Executive Committee, which gave rise to the formation of this committee on the best method of disposing of the dead. I think there are arguments to show that there are positive dangers to public health resulting from the contamination of our soil and water by decomposed bodies, buried according to our present methods of burial, sufficient to convince any thinking person of the necessity for a reform; and I would advise friends who have not done so to read the paper referred to by Dr. Morris. It will convince everybody. Another thing he speaks of: A village composed of workingmen, who left their houses in the morning and went home quite late in the night. An epidemic of typhoid fever broke out, and the persons affected in that village were only the women and children who drank of particular water from a particular well. All the men who did not drink of the water were exempt from the fever. This is one of numerous instances, and I have no doubt that there are many evidences of infectious disease having been traced to this same source, and I would like this association to express an opinion on the subject of cremation.

Dr. Rohé.—One thing I want to say: When I am convinced, I shall certainly vote in favor of such a measure. When I am convinced that cremation is not merely an economic argument, but is also a sanitary argument, I shall be in favor of adopting it and advocating it. Whenever any municipality, in this country or elsewhere, in times of epidemics, possesses a crematory sufficiently large to destroy by fire all the bodies that may be brought to it in times of epidemics, then I shall vote that this association shall pass a commendatory resolution.

Dr. Abbott, of Massachusetts.—I wish to say one thing. The only valid argument against cremation is that of the prevention of the detection of crime in certain cases. This matter was brought before the legislature of Massachusetts at its recent session, in the shape of a bill for the formation of cremation societies. The question came up in regard to this matter of the detection of crime, and it was very readily met in this way: We have in Massachusetts, as you know, a very thorough system of medical examination in all cases of sudden or suspicious death. Our present medical examination system has done away with the old coroner's system. Since 1877 not a single coroner's jury has set in a case of death;

and in that time 15,000 cases have been investigated without the slightest complaint from any of the people. It is therefore provided in every case, in addition to the usual certificate of the physicians, a second certificate shall be given, or the name of the medical examiner of the district attached,—that is, he should look into it, and see if any further action is required. If in his judgment an autopsy is required before cremation, he is to make his report accordingly.

Dr. Thomas Taylor.—I desire to say a few words with regard to the general method of making a chemical analysis of water.

A chemical analysis has some value in determining the general purity of water, so far as relates to the presence of albuminates, soluble or insoluble, the character of the salts present, common salt, urates, etc., but so far as bacteria are concerned, chemical analysis has no value whatever. Bacteria are plants which may propagate in what would be considered very pure water. They are generally of such minute character as not to be even taken into account in chemical analysis, inasmuch as, if discovered at all, they would be considered as just so much vegetable matter.

Think of a living germ, the fifty thousandth part of an inch in size, which under a favorable method of propagation gives rise to fifty millions of living germs in the short space of twenty-four hours, and yet the aggregate of fifty millions does not exceed the one hundredth part of an inch in bulk!

Without the aid of a microscope these germs cannot be distinguished from ordinary vegetable matter by chemical analysis, if seen at all; and this leads to another consideration of this subject.

Globular bacteria are the smallest of living germs, and the dimensions of some species are so minute that they cannot be measured directly. They are motionless, so far as can be observed. Therefore a dead bacterium would appear under the microscope in the same condition as one alive. How necessary, therefore, it is to ascertain by cultivation, after the method of Pasteur and others, whether bacteria found in suspected drinking-water are living or dead, poisonous or harmless.

The presence of common salt in drinking-water is not necessarily injurious, neither does it always come from underground sewage. Common salt seems to be omnipresent: it is found in the air, rain-water, and earth at all times. Sometimes it may be shown that salt water in our wells comes from defective sewer-pipes. Albumen, in like manner, is not in itself hurtful. The decomposition of vegetable matter on the surface of the soil may find its way to our wells. The same is true of animal matter, but unless the animal matter contained poisonous germs, no harm would come from drinking such water.

Dr. Morris.—How do you explain the presence of nitrates in well water?

Dr. Taylor.—Nitrates are continually forming on the surface of the earth. Nitric acid is formed in the atmosphere during thunder storms, and descends to the earth with the rain. It may combine directly with the potash liberated from decomposing vegetable matter and from other

sources, and find its way by percolation to our wells; but were nitrate and common salt and albumen found in well water in excess, it would probably be found to proceed from sewage, and might contain typhoid germs, but this cannot easily be demonstrated.

The governments of Europe make large quantities of nitrate of lime by exposing animal matter, in combination with lime, to the atmosphere for a term of years. The decomposition of animal matter in contact with lime creates the nitrate of lime. By treating this nitrate with potash, nitrate of potash is formed, which is a soluble nitrate. Nature may and does effect all this, and therefore nitrates may be found in our wells from surface sewage.

Dr. Hibberd.—I would like to say one word. I would like to say, first, as a general proposition, that I am in favor of cremation. I think it would be a good way of disposing of the dead for those who have no religious or sentimental scruples, independent of avoiding contagious disease; but I am with Dr. Rohé, and those who think as he does, that so far there has not been any testimony presented to my mind convincing me that contagious diseases have been spread from bodies. Now it may be that my friend, Dr. Morris, if he had read his paper clear through, might have convinced me. I am like Dr. Rohé in saying that whenever evidence comes to me, I am willing to accept it. My theory of cremation is on general principles, that it is a good way of disposing of dead bodies that are no longer useful. I do not think we can take such facts as are presented by my eminent friend from Michigan as satisfactory evidence of the conclusion he arrives at. We must know whether anybody having died from typhoid fever was buried on that hill. Then we must have positive testimony that between the time of that burial and the time the water might have got down into the valley there was not time enough for the contagious germs to have lived their natural life and died out. In the next place, we must know not only that there was a general decline that induced the water to run down, but we must know that it went right from the spot where the man was buried who died of typhoid fever, down to this well where the people got their drinking-water. Before this evidence can be taken as entirely satisfactory, it must be shown that the contagion cannot come from any other source.

The testimony from Baltimore, it seems to me, involves so many factors that have been given no expression at all, that we must quietly lay them to one side until they are presented. I am going to read Dr. Morris's paper with a great deal of care, and if I am convinced, I am willing to get up, as I do here to-night, and make public expression that I have been mistaken, and that it is true that cemeteries will convey poisonous material. I think you may safely drink water within two rods of all cemeteries.

Dr. Quimby.—I am one of the doubting kind, also, as to the detriment of cemeteries, and as to the fact that we have no positive evidence. Besides, no man knows, after a man has died of typhoid fever, yellow fever, scarlet fever, or small-pox, how far that disease still continues.

Therefore, until we find that out we are in the dark. Does any man know that in twenty-four hours after death anything of that disease remains? I have known a great many people to drink water found in close proximity to grave-yards, yet I have never known anything to come from it. The case in Baltimore is no proof, by any means, because there are other methods of contamination, and I do not think it is fair to trace it to grave-yards.

The PRESIDENT.—The Chair would state that he knows of an incident where typhoid fever was conveyed thirty miles. It is worthy of consideration in connection with this discussion.

The Chair wishes to announce that gentlemen present belonging to the Advisory Council are notified that there will be a meeting of that body for business after this meeting adjourns. There is a motion that the Committee on Disinfectants make a preliminary report to-morrow morning.

The question was put on the motion, and carried.

On motion, the Committee on the Disposal of the Dead was also continued.

The association then adjourned until Friday, December 11.

FOURTH DAY.

FRIDAY, December 11, 1885.

MORNING SESSION—10 O'CLOCK.

The hour of 10 o'clock having arrived, the association was called to order by the President.

The PRESIDENT.—The first thing in order is the report of the Executive Committee.

The SECRETARY.—The Executive Committee recommend the following names for membership. (Names in list.)

The Secretary began to read the names, when he was interrupted by the President.

The PRESIDENT.—The Chairman of the Committee of Arrangements desires to make a report.

The CHAIRMAN.—I have no addition to make to the programme that you have in your possession. I merely wish to state, however, that the street railroads passing the door will take you to the wharf. Tickets will be furnished in the Secretary's office. These tickets will carry you on any railroad in the city. I wish to state, also, that the two Mr. Nailors—Mr. Wash Nailor and Mr. Allison Nailor—have cabs on the streets. One is named Wash Nailor and the other Allison Nailor. Mr. Wash Nailor has liberally offered to take the members of the association wherever they wish to go at a reduction of 25 per cent. So you will just recollect the name—Wash Nailor. The name Wash Nailor is on the cab. You will save 25 per cent. in this way. The other Mr. Nailor has refused to do

this for us. As I said yesterday, I expect every member of the association will invite his representative in congress to attend our oyster roast. We have no other means to invite them except through you.

The Secretary continued and concluded reading the names of persons proprosed for membership.

On motion, the Secretary cast the ballot of the association for the names as read; and the persons whose names had been read were admitted as members of the association.

The SECRETARY.—I am also requested to announce that the local committee ask leave to present for membership those who contributed to the success of these meetings financially. There are a number of citizens of Washington who have contributed to our success, and I beg leave to have them put on the list of associate members.

The names were read by the Secretary.

On motion, the Secretary was instructed to cast the ballot of the association for the persons named. The ballot was cast by the Secretary, and the persons whose names were read were declared elected associate members of the association.

The SECRETARY.—The name of Dr. John E. Gilman, I am told, was omitted yesterday from the list when it was read. However, I believe it was read, but if not, I wish to have it put in.

On motion, the Secretary was instructed to cast the ballot of the association for Dr. John E. Gilman, which was accordingly done, and Dr. Gilman was declared duly elected a member of the association.

The PRESIDENT.—The next thing in order is the report of the Auditing Committee.

The report was read, and on motion adopted.

The SECRETARY.—The Executive Committee recommend that the Committee on the Disinfection of Rags be increased to seven members.

On motion, the recommendation of the Executive Committee was adopted.

The PRESIDENT.—I appoint as the additional members of that committee Dr. Raymond of Richmond, and Dr. Holt of New Orleans.

The SECRETARY.—The Executive Committee recommend, on the resolution in relation to the disinfection of sewers offered by Dr. Raymond, as follows: That it be referred to the Committee on Disinfectants, and that that committee be continued for one year.

On motion, the recommendation of the committee was adopted.

The Secretary read a letter addressed to the American Public Health Association from Dr. Thomas F. Wood:

To the Executive Committee of the American Public Health Association:

I am directed by the conference of the state boards of health to request that the American Public Health Association appoint a committee, or designate some means, to restudy the question of the antiseptics of vaccination.

1. As to the storage and transmission of virus.
2. As to the antiseptic care of vacciniferous animals.

THOMAS F. WOOD, M. D.

The SECRETARY.—The Executive Committee recommend that this letter, and the resolution which it contains, be referred to a special committee of five to consider it.

On motion, the recommendation was adopted.

The SECRETARY.—The communication from the Conference of state boards of health in relation to the time of holding meetings, presented to the chairman of the committee on state boards of health, is reported upon as follows:

Resolved, That the representatives of state boards of health constitute a section of the American Public Health Association, to be called the "Section of the State Boards of Health," which shall elect its own chairman and secretary; and that the Executive Committee, through the Secretary, arrange for the meeting of this section on the day preceding the general session of the American Public Health Association; and that the Executive Committee arrange a day or portion of a day during the general session for the exclusive consideration of matters relating to state boards of health, and for the reception of reports and propositions from the section of state boards.

On motion the report was adopted.

The SECRETARY.—The Executive Committee recommend an amendment to article 9 of the constitution, by inserting after the word "members" in the third line, the words "of whom three shall be elected annually by ballot to serve two years, and who shall be ineligible for a second successive term."

The PRESIDENT.—This amendment will have to lie over for one year.

Dr. GIHON.—Mr. President, as this amendment is only in the line of the amendment which we adopted on the first day of the session of this association, will it not be possible for us to reconsider the adoption of article 9 and incorporate this in it, and then adopt it? That would, I think, be the best course, and for this reason: We are going to publish the indices, and we are going to publish the constitution, and we are going to publish all the rules and regulations, and if this amendment is incorporated in the constitution now no alteration will be required. But if they are not incorporated now, an alteration of the constitution will be required after it has been printed. If this can be put in now, the constitution and all can be printed, and there will be no difficulty about it. The work will then be finished, and there will be no need of further change. I suppose that I have the right to move that it be reconsidered, inasmuch as I voted on the prevailing side. What I wish can be done by unanimous consent, if there is no objection.

The vote by which the constitution was amended at the previous session was reconsidered, and the amendment proposed by the Executive Committee was incorporated in it, and the amendments were then adopted as a whole.

The SECRETARY.—On the resolution which was offered last evening in regard to school hygiene the committee report and recommend the adoption of the resolution.

On motion, the resolution was adopted.

The SECRETARY.—The following is from the Advisory Council:

At a meeting of the Advisory Council the question of the advisability of soliciting governmental aid in prosecuting scientific researches into the causation of the infectious diseases of man was considered, and the following action taken:

The Advisory Council finds that while some provision has been made by private individuals and associations throughout the country for the investigation of the causation of the infectious diseases of man, the national government has, in its organization of the Army Medical Museum, the Museum of Hygiene, and the Bureau of Animal Industry, not provided these departments with adequate facilities for experimentation in this field; and it therefore recommends that congress be urged to appropriate the necessary funds so that these departments may be equipped with proper laboratory facilities for this purpose.

The council therefore recommend that the Executive Committee of the American Public Health Association be instructed to urge upon the congress of the United States the importance of legislation in this matter. The resolution submitted by Dr. Holt advocating the appointment of a commission of experts to investigate yellow fever in its breeding-places was also endorsed, and the recommendation made to instruct the Executive Committee to urge upon the President the appointment of such a commission.

A resolution was adopted referring the question of publication of the prize essays to the Executive Committee with power to act, recommending that they be disseminated as widely as possible. The Executive Committee was instructed to have the report of the Committee on Disinfectants copyrighted and make provision for its publication, provided that any board of health or health officer desiring to publish extracts from said report shall have permission to do so upon giving proper credit to the association for the extracts made.

Toronto, Canada, is recommended as the next place of meeting, the time to be fixed by the Executive Committee.

For President.

Dr. H. P. Walcott, of Massachusetts.

For 1st Vice-President.

Dr. C. W. Covernton, of Canada.

For 2d Vice-President.

Dr. G. B. Thornton, of Tennessee.

For Treasurer.

Dr. J. Berrien Lindsley, of Tennessee.

For Executive Committee.

Dr. Pinckney Thompson, of Kentucky.
Dr. H. B. Baker, of Michigan.
Dr. Joseph Holt, of Louisiana.
Dr. Hosmer A. Johnson, of Illinois.
Dr. F. Montizambert, of Canada.
Maj. Chas. Smart, Surg. U. S. A.

The Executive Committee recommend its adoption.

Dr. Rauch.—I move that that part of the report requiring the association to copyright the paper on disinfectants be omitted.

On motion, the amendment of Dr. Rauch was adopted, and the report of the committee as amended was on motion adopted.

Dr. Quimby.—There is one other suggestion which I would like to call attention to. It seems to me, in reference to soliciting governmental aid, that we ought to have a special committee appointed for that purpose.

The President.—The Executive Committee have that whole matter in charge.

Dr. Quimby.—I understand that. Allow me, sir, to finish. It seems

to me that we ought not to put so much on the Executive Committee. We are putting too much work on them. They have more than they can do. They have so much to do that it cannot all be attended to by them. I ask for a special committee to be appointed for the purpose.

The PRESIDENT.—You have heard the suggestion of Dr. Quimby.

Dr. GIHON.—It is the special duty of the Committee on Publications to attend to that.

Dr. QUIMBY.—It is a matter which should be attended to.

The PRESIDENT.—The question will now be put on accepting the report of the Executive Committee.

On motion, the report was accepted and adopted, and instruction given to carry out the suggestions therein contained.

The SECRETARY.—I am requested to announce that Mr. Lomb will offer some additional prizes on different subjects for the ensuing year. These prizes are to be upon plans for houses. The houses to be built from the plans should cost from $600 to $1,500. The first prize will be $100, the second prize will be $75, the third prize will be $50, and the fourth prize will be $25. The details, however, have not yet been presented, and I simply make the announcement that such prizes will be offered.

The PRESIDENT.—I move that the association receive the further donation so kindly made by Mr. Lomb, with thanks.

On motion, the resolution offered by the President was carried.

Dr. GERMER offered the following resolution, which on motion was adopted:

Resolved, That the subject of the proper disposition, by cremation or otherwise, of garbage and animal refuse be referred to the Committee on Cremation of the Dead, with instruction to report at the next annual meeting.

Dr. THORNTON.—Mr. President, I wish to offer this resolution. It pertains to Dr. Billings's paper, which has not been discussed:

Resolved, That a committee of three be appointed to draught a suitable form for municipal, weekly, monthly, and annual mortality reports.

Dr. THORNTON.—The object of this, sir, is to have this association recommend or adopt uniform tables for making out mortality reports, which will facilitate very much the labor of those who study and compile them. I also suggest that Dr. Billings be made chairman of that committee.

On motion, the resolution was adopted, and Dr. Billings made chairman of the committee.

The PRESIDENT.—Gentlemen of the Association, I have the honor to announce that the Advisory Council for the coming year will consist of the following members.

The Secretary read the names. (See Advisory Council.)

The PRESIDENT.—I wish to state to the association that I have no concealment about anything which I do here. I have appointed on this

committee those persons who did active work in the past year. I do not know these gentlemen, some of them, personally, and have no personal preference.

The next thing in order was new business.

The SECRETARY.—The Special Committee on Infected Rags submit the following report:

The special committee to which was referred the resolutions of the Philadelphia Board of Health touching the importation of infected rags, begs leave to submit the following preliminary report:

WHEREAS, It is an admitted fact that the importation of rags is a prolific source for the spread of infectious diseases, and that the seaboard cities which are ports of entry are the gateways through which this infection enters, and is distributed throughout various sections of the whole country; and

WHEREAS, There are grave doubts as to the efficacy of the methods of disinfection used abroad; therefore,

Be it resolved, That it is the judgment of the American Public Health Association that all health authorities having jurisdiction over matters connected with maritime sanitation owe it as a duty to the general public to adopt such uniform systems of disinfection as will thoroughly destroy all disease-bearing germs before the rags are permitted to be distributed for manufacturing purposes.

Resolved, That the Secretary of this association be directed to forward a copy of this resolution to all boards of health and health officers having jurisdiction over maritime sanitation on the Atlantic and Gulf coasts of the United States, and referring them for methods of disinfecting rags to the Report of the Committee on Disinfectants, page 126, as follows:

" Rags in bales can only be disinfected by injecting superheated steam (50 lbs. pressure) into the interior of the bale. The apparatus used must insure the penetration of the steam to every portion of the bale "

(Signed) J. HOWARD TAYLOR.
A. N. BELL.
H. B. HORLBECK.

Dr. J. H. RAYMOND.—Mr. President, I desire to ask a question for information. I wish to know whether that resolution implies that the rags must be disinfected at the port of entry.

The SECRETARY.—Yes, I think it does.

Dr. RAYMOND.—I do not think it carries that idea with it. It does not so seem to me. I would like to have the Secretary read that again.

The resolution was again read.

Dr. GIHON.—I move that the report of the committee be accepted.

Dr. C. A. LINDSLEY.—I am somewhat interested in that resolution. The port of New Haven is the only one in the United States to which all cargoes of rags go. We have very satisfactory evidence—evidence that is entirely satisfactory to us—that these rags have been thoroughly disinfected by superheated steam before they are put into bales. It does not seem just to the proprietors of these cargoes that they should be again subjected to this disinfection upon reaching our ports, and for one I am hardly willing to be bound by that resolution as the health officer of New Haven. I will not commit myself to it.

Dr. J. S. BILLINGS.—The object of the recommendation to the association by the Executive Committee for the appointment of a special

committee to investigate the subject and to report at the next meeting of the association was to give time for a careful and deliberate consideration of the subject. We wish to collect some experimental data as to the actual effect of different processes upon rags in bales. We should endeavor to reconcile if possible the interests of the public health and the prevention of any importation of diseases with the interests of commerce. It seems to me that it is premature for the association to commit itself to this exceedingly strong demonstration without waiting for a deliberate report of the committee which would carry conviction with it. I am not prepared to vote in favor of any such declaration as that without the detailed evidence resulting from a careful investigation of the whole subject, and I move therefore that the report be referred back to the committee.

Dr. A. N. Bell.—I desire to make a few remarks. I have in my hands letters from inspectors abroad who state that they have no confidence in the means now used. I also have another very important letter from one of the chief rag importers in New York.

The President.—In view of the shortness of the time, would it not be well to limit the discussion?

Dr. Bell.—My object is not to discuss the subject. I am informed that these gentlemen who oppose this motion are not affected at all. Rags have never been so cheap as they are now, and even when they cost to the extent of six and seven dollars per ton the expenses have been on the importer. These imported rags have not cost one dollar more on account of these strictures; and I have it here, from a house of forty years' standing, and they say that this is so. The point raised here is merely, Mr. President, that we want this report from the committee so that we might have all this evidence before us referred to by Dr. Billings. We want to have a report which shall contain evidence sufficient to carry conviction with it to everybody, and not have the appearance of anything like snap judgment. Any action of this kind on our part should be the result of careful and deliberate consideration.

Dr. Benjamin Lee.—Mr. President, I trust that motion will not be carried. It is a matter of extreme importance for the sanitary authorities of Philadelphia that this association should back them up in the effort which they are now making to prevent the distribution of rags from infected ports through that state. It is only necessary that there should be an expression of opinion here. It is not necessary, for the expression of such an opinion by the association, that the whole matter should be gone into now. All the people want is, that the American Public Health Association should put itself on record as against infected rags from foreign ports suspected of infection. All we desire to accomplish is, that such rags should not have an opportunity of being taken from a port which is infected to another port, and then sent back into one of the states, carrying disease in their track. That is what we wish, and it is for this reason that I ask for a preliminary report.

Dr. Gustavus Devron.—I have the same desire that Dr. Billings

has, not to give snap judgment in any case. But I, certainly, for one, would prefer to stand the whole imputation of having given a snap judgment than to hold back in a case like this, when I know by acting in the matter I am saving human life. Health is wealth, and we must make every sacrifice to secure health. To wait one day or one year for another report might make this association responsible for what misfortunes may happen between this time and the next year. What diseases may be conveyed by rags during that period of time we cannot tell. But we do believe, and all men do believe, that rags have often conveyed the germs of diseases of various kinds. I consider it our duty as sanitarians, even if it costs three times the value of the rags to save one man's life, to do so.

Dr. Billings.—I am very sorry that the association takes this stand, but I think we want, as I say, the evidence, and I say that there is no satisfactory evidence of the production of infectious or contagious diseases from baled rags. I want to see that evidence. There is evidence that the rags collected in this country have produced and given rise to small-pox; but I say that there is no evidence that baled imported rags have been the cause of disease in this country. I want to see the evidence of it, and I protest against a member of the association being compelled to vote on the resolution when the evidence and details are not submitted. If boards of public health are going to be a success in this country, you have got to consider the interests of the commercial class. They are a part of the people. There are interests sometimes even more important than life or health. We saw the truth of this twenty years ago. We did not pay much attention to life or health in 1863 and 1865. I do not say that this is necessarily a case of that kind, but this report must carry conviction with it to have the support of public opinion.

Dr. Bell.—I have the evidence, and I am ready to produce it. I have been gathering it for twenty years. Case after case can be cited on this question as rapidly and as surely as on any other. Cholera has been conveyed again and again, so has small-pox, in baled imported rags.

Dr. H. P. Walcott.—I am going to trespass on your time for a few minutes, for the reason that I am somewhat interested in, and know something about, baled rags. The state of Massachusetts uses more baled rags than any other state in this Union. I have been connected with the board of health ever since 1869, and have had some experience in these matters. We have in our state statistics covering thirty or forty years in regard to baled rags. In all that time there has not been a particle of evidence that any disease has ever been imported in foreign rags. There has not been a suggestion of it. The only diseases that have ever been noticed have been those which were brought in mohair, but with that exception I know of none other. All our troubles have come from domestic rags.

Dr. J. H. Taylor.—Two distinct outbreaks of small-pox near Springfield occurred among the operators in one of the manufacturing establishments there from baled rags. The rags came from New York. The

case occurred among the occupants of the establishment. It then spread to the families of the occupants, and there were four other cases and about two deaths. They use there mostly imported rags. The rags that they were using at that time came from New York.

Dr. Pinckney Thompson.—We certainly have had enough of debate to satisfy us as to what we ought to do, and therefore I move the previous question.

The motion of Dr. Thompson was put and carried, and the previous question ordered.

Dr. Thompson.—Now the question comes up on the original resolution.

Dr. Billings.—The resolution is that this matter should be referred back to the committee for a full report.

A division was taken by the association on the original question, which resulted ayes, thirty-one; nays, twenty. The original resolution was declared to be adopted by the President.

Dr. Rohé.—I am not aware whether the report of the Committee on Disinfectants has actually been adopted by the association or not. I would like to know that. I am not willing, as a member of the committee, that it should be placed here merely on sufferance, and that its report should be merely adopted as a contribution. I want to know whether the association is willing to receive and adopt that report as a part of its own work. There seems to have been some misunderstanding about that. I have been asked about it several times——

The President.—The report has been received, and has been ordered published.

Dr. Raymond.—In connection with what we have done, if our action is to be of any effect, it is absolutely necessary that we have some money. The amounts heretofore received have been obtained by begging, and, for one, I do not care to beg. This is not because I do not care to beg in itself, but that I fear we shall not be successful. The committee this year has been relieved of a personal liability of $131. You have now placed on the committee the work connected with the subject of disinfection of rags. There should be some provision made for expenses. It is absolutely impossible to do this work unless there is some provision for it.

The President.—It is perfectly competent for this association to provide the means for its work.

Dr. Rauch.—I think the association should make the appropriation so as to continue its work in a satisfactory manner, and we should not leave the committee in a crippled condition for want of money.

The President.—The expenses were partly borne by the state boards of health. The state of Illinois was exceedingly liberal, and I know she will be liberal again.

Dr. Thompson.—I move to refer this whole power to the Executive Committee, with power to act.

The motion made by Dr. Thompson was carried, and the reference made.

The PRESIDENT.—Is there any further unfinished business?

Dr. GIHON.—Mr. President, I have a resolution which I now offer:

Resolved, That the thanks of the association be extended as following for courtesies received:

To Mr. Henry Hurth of the Washington & Georgetown Railroad Company, Mr. Pearson of the Metropolitan Line, and Mr. Henry A. Willard of the Columbia Line, for the courtesy of free transportation on the railways mentioned;

To Mr. Staples, of this hotel, for the use of the hall free of charge, and his many kindnesses to members of the association under his roof;

To Mr. Washington Nailor for concession in reduction of cab and carriage hire;

To Mr. C. B. Schafer for cards of invitation to partake of the mineral waters at his establishment;

To trustees of the Corcoran Gallery of Art;

To the board of management of the Cosmos Club;

To the representatives of the press for their admirable reports of our Proceedings.

The question was put, and Dr. Gihon's resolution was carried.

The PRESIDENT.—The next thing in order is the list of the Advisory Council.

The list of the Advisory Council was then read.

Dr. BRYCE.—I desire to decline as a member of the Advisory Council, as my colleague Dr. Covernton is a member of it.

On motion, the Secretary was instructed to cast the ballot for the names presented by the Advisory Council, which he accordingly did.

Dr. GIHON.—I nominate Dr. Hewitt, of Minnesota, for the vacant place on the Executive Committee.

The question was then taken, and Dr. Gihon's motion was carried.

The PRESIDENT.—Gentlemen of the Public Health Association: I have the honor and the exceedingly great pleasure of presenting to you a gentleman, a scholar, a physician, and a sanitarian, one of the oldest state board of health men in the United States. Commencing with dear old Massachusetts, in 1869, by her example I see the influence has been sent out all over this land, which has given us thirty state boards of health, and we have attempted to-day to do honor to her in memory of her great and good work by the election of her honored son as President of this association. I have the pleasure of introducing to you now my successor, Dr. Walcott, of Massachusetts.

Dr. WALCOTT.—Mr. President and Members of the American Public Health Association: I believe that preventive medicine is to have in this country a place better than even the most enthusiastic of us have dared to claim for it. I am confident that this association in that work will honorably lead, as it has always done. You have seen fit to place in my hands for one year your highest honors. With humility I accept them. With all that is at my disposal I will defend them, and undiminished, if I may, will hand them to a worthy successor. In my own name and in that of my state I thank you—with all my heart I thank you. (Applause.)

The PRESIDENT.—Gentlemen, we have again the old adage exemplified on this occasion, that the first shall be last, and the last shall be first.

Professor Lindsley has a very short paper, which was accidentally omitted from the programme last night. He will now come to the stage and read his paper on typhoid fever. (See page 38.)

The President then announced the Committee on Disinfectants.

Hon. John Swinburne was then introduced, and spoke as follows:

I first became interested in the subject about thirty years ago, and believe the first case of diphtheritic exudations known in this country occurred in my own family, with fatal results, and now I understand it has become prevalent in every part of the nation; and it seems to me that thus far the medical profession has been unable to grapple with the disease so as to understand intelligently how to treat it, and more especially what is the preventive. It is certainly lamentable that we are unable at any time to discover the cause of the malarial diseases which destroy our homes. As with our own country, the growth of these zymotic diseases has been rapid in other countries. As an instance, we take the history of Mexico, where I read and understand that in the earlier days there were comparatively no diseases of this nature, although the population, it is believed, was larger than at the present time, when almost every form of disease exists. The simple but very important question arises as to what has caused this change there from almost absolute immunity from disease to the conditions now existing. In proportion as civilization has advanced there has been a corresponding advance in what are known as zymotic diseases, and an equally corresponding advance has been made with respect to a knowledge of their nature, so that now we realize that a large portion of this class of diseases we have to treat arises from deficient sanitary arrangements, bad food and water, and impure air. But from my observation I have been unable to discover where science has made any remarkable advance demonstrating the cause of the rapid development of these zymotic troubles. There are diseases of which we know something with reference to their development and growth, as for instance ship fever. This is a disease peculiar to vessels as the result of over-crowding passengers, poor food, foul air, impure water, and to human exhalations. For nearly ten years, in 1847, that disease spread all over this country, when thousands died from its ravages; and during that period it was an important element, with others, in almost decimating Ireland, or at least in reducing the population from eight to three millions of souls. So far as I know it has never broken out in this country except in jails or in crowded camps. The disease would be as virulent on land and in dwellings as on the sea in ships under the same circumstances.

As late as 1860, in the city of Albany, New York, where I reside, we had no cases of typhoid fever, while through the Mohawk and Hudson valleys, seemingly the most healthy places in the world, more or less fever prevailed; but in recent years it has been quite prevalent at and in the vicinity of Albany. It seems to me that the so-called scientific men of to-day are running in the wrong direction, and that more practical methods should be adopted in this country for the purpose of ascertain-

ing the causes and preventing the spread and continuance of these diseases. I think one great trouble in this country is, that we have run our drains through our dwelling-houses, and that these drains are not properly ventilated outside, and that the exhalations from these drains are intensified because of our modern improvements in placing our water-closets in our dwellings. Those of you who are familiar with old countries know how these matters are arranged. In Paris every corner has a street ventilator, and drains, of which there are two, one for the carrying off of the fecal water and the other the surface waste-water; and these are so large that you could live in them. I have examined several of them, and have found them so clean that there could be no sewer-gas coming through. Another source of disease is our water-supply. In Albany I saw little devil-fish, and every conceivable thing living in the water, coming up through the pipes into my residence. In some places the water commissioners have run their drains into receiving reservoirs, supposing that would purify the water; but it did not, and the impure waste water ran into the retaining reservoirs.

So far as I am informed I know of no careful consecutive examinations of the fluids in the drains from which these deleterious and disease-breeding gases emanate, either chemically or under the microscope. I assume that as medical men we have no right to a theory, and that our search should be for facts. I remember not long since an eminent divine asked me what was the theory of certain things. My answer was, There is no theory. The question arose as to the growing of tissues under the influence of heat and moisture. I told him that God Almighty had demonstrated that as a fact, and that we are all or should be seeking after facts, and are endeavoring to discover what are the causes and the great remedies. In all organizations of this kind there should be divisions into sections, some sections investigating as to facts, others for remedy, others for the most feasible way of correcting existing evils. Many of the annoyances that we have suffered from very lately are zymotic troubles, blood poisons. Still we call them diseases, and speak of them as diseases. I think practical men should guide such an organization as this. It is very well to have theories, but you want a balance-wheel. Zymotic diseases are increasing instead of diminishing, and it is our duty to try and prevent their spread. If we say to the public, We will tell you how to prevent pneumonia, and tell them that one simple fact, they will bless us forever. Again: We might call gangrene a disease, yet it is only a condition. If you have a part gangrened and can restore circulation, that is the end of gangrene so far as its extension is concerned. I speak of gangrene in youth. In old age it is a different thing, but at the same time it is not a disease, but rather and only a condition,—that is, it depends on the condition of the nerves and arteries.

Dr. Raymond.—I hope that Dr. Swinburne will kindly give his assistance to the measures which may be presented from the Executive Committee regarding appropriations for the investigation of diseases in man.

Dr. G. N. Bell presented a paper on "Hygiene of the Dwelling," which was read by Dr. A. N. Bell. (See page 120.)

Mr. Lomb.—Mr. President and Members of the American Health Association: I have the honor to return my sincere thanks for the kind expressions of approbation of what I have done, and for the good-will you have shown me, and the honor you have done me in electing me a life member of this organization. I assure you I shall always be proud of this, and endeavor to the best of my ability to assist the good work of the association as much as possible. I thank the judges who by great sacrifice of their own interests and time have done so much to make the matter a success, and also the officers of the organization who have done so much for the amount of money expended. Of course it has been a work for the benefit of the people, and they will thank the association, and the judges, and the officers for that. I feel as if it was my personal duty to thank you. (Applause.)

The President.—The next business in order will be the reading of a paper by Dr. Partridge in regard to cattle disease. (See reports of committees.)

Professor Salmon.—There is one little error in the report which has just been read which I do not think should go on the records without correction, and that is in regard to the measures for preventing Texas fever, in which it is stated that the sick animals should be destroyed. This is not considered necessary in Texas fever. I would recommend the correction be made in that respect.

Dr. Partridge.—I was under the impression that was the course pursued. I must say, however, in explanation, that this report was not submitted to the other members of the committee. I could not find them, and it is subject to correction at this time.

The President.—I have already appointed Dr. Bryce chairman of the Committee of Arrangements for the next meeting, with power to see the committee at his pleasure.

Dr. Rauch.—Before the association adjourns, I move that a vote of thanks be given to the retiring President.

The question was put by the Secretary and unanimously carried.

Dr. Gihon.—Before the association adjourns, I would also like to move that a vote of thanks be given to the Secretary and Treasurer for their efforts in our behalf.

The question was put, and unanimously carried.

Dr. Rauch.—I would move also that a vote of thanks be tendered the local committee for their untiring efforts in our behalf.

Dr. Gihon.—May I ask Dr. Rauch to mention the names in that committee of the chairman and secretary, Dr. Smith Townshend and J. C. McGinn.

Dr. Rauch.—I accept the amendment.

The question was put and carried unanimously.

Dr. Gihon.—I now move that we adjourn.

The President.—The motion to adjourn is always in order, but

before putting the motion I beg that you will bear with me a moment. We have now reached the conclusion of the exercises of this thirteenth annual meeting of the American Public Health Association. Several years ago a few earnest, honest physicians and sanitarians determined that, in order to cultivate and make popular sanitary matters in this country, some organization of the efforts of the friends of sanitation should be accomplished, and thereupon they met in solemn council—twelve or fourteen patriotic gentlemen. You see to-day the result of their labors. We have grown to be a power, not only in this land, but recognized as a power and influence in sanitation wherever the English tongue is spoken. We have a literature of which we may be proud. Our influence is still on the increase. At St. Louis I had the honor of being entrusted with the helm of this association. I have endeavored as earnestly as God gave me power to direct it to this meeting. I flatter myself that we have made some progress; and with clean hands and an honest heart, and with a determination to follow in this direction so long as life shall be given me, I turn over to my successor the work which has been committed to my charge. (Applause.)

Then, on motion, the association adjourned *sine die.*

REPORTS OF COMMITTEES.

PRESENTED AT THE THIRTEENTH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, WASHINGTON, D. C., DEC. 8–11, 1885.

REPORT OF THE COMMITTEE ON STATE BOARDS OF HEALTH.

After the conference of state boards of health at St. Louis, in October, 1884, it was decided by the Executive Committee of the American Public Health Association to increase the number of their standing committees by establishing one on state boards of health.

Your committee, having attended to the duties assigned them, beg leave to submit the following report:

It is with feelings of sadness that the committee have to report the death of two of its members, viz., Dr. F. W. Hatch of Sacramento, Cal., and Dr. J. G. Thomas of Savannah, Ga. Both were well known to the sanitarians of this country, and we trust proper notice of their death will be found upon the records of the association. The President, Dr. Reeves, has appointed Dr. George Homan of St. Louis, and Dr. Thomas F. Wood of Wilmington, N. C., in place of the deceased.

It is a pleasure to announce to the association that since our last meeting three new state boards of health have been established, and are now fully organized. Maine, Pennsylvania, and Kansas have completed their health organizations, and from the well known professional character of the members in each state we may rest assured they will prove worthy of the work in which they are engaged.

After correspondence with the other members of the committee, on the 12th of October the chairman issued the following circular letter to all the state boards of health in the United States, also to the board of health in the province of Ontario, and a few days later to the board of health in the province of Quebec, that had just been organized to meet an emergency caused by the epidemic of small-pox in Montreal:

CONCORD, N. H., October 12, 1885.

To the Secretary of the State Board of Health of ——.

DEAR DOCTOR: At the last meeting of the American Public Health Association, a Committee on State Boards of Health was appointed, and it was suggested that the various state health organizations bring before the association, through this committee,

papers, reports, suggestions, or any work of interest to their organizations or the association.

It will be a pleasure for me, as chairman, to lay before this committee, at its meeting in Washington, next December, any matter of this kind; and if sent to me in season, the action of the committee will be reported to the Executive Committee of the association, in order that suitable papers may be placed upon the programme for reading at the proper time. An early reply is therefore solicited.

With great respect, I have the honor to be your most obedient servant,

G. P. Conn, *Chairman.*

In due time responses were received from twelve states, and from the provincial boards of health in Ontario and Quebec. Massachusetts, Rhode Island, Connecticut, New York, and Pennsylvania neither made suggestions nor offered papers.

Dr. E. M. Hunt, of New Jersey, suggested that the several state boards enter upon a systematic collection of facts concerning sickness and the registration of vital statistics in their respective states.

Dr. Hunt will read a paper upon "Sanitary and Statistical Nomenclature," and discussions upon that subject very properly should follow the reading of his paper.

Dr. H. B. Baker, of Michigan, suggested that the several state boards of health enter upon the systematic collection of facts concerning the sickness in their respective states, and the coincident meteorological and other conditions liable to affect health, with the view of learning the cause of diseases, in some such manner as is being done by the Michigan State Board of Health, as set forth by its secretary at the meeting of the American Public Health Association at St. Louis, in October, 1884, and printed in the Transactions. As the volume of Transactions referred to has been distributed to the members by the Treasurer, it is a pleasure for the chairman of this committee to call your especial attention to Dr. Baker's article on "The Relation of the Depth of Water in Wells to the Causation of Typhoid Fever," p. 184, vol. 10, of the Transactions.

Dr. S. S. Herrick, secretary, reports that Dr. Joseph Holt, president of the State Board of Health of Louisiana, will read a paper upon "The Sanitary Protection of New Orleans, Municipal and Maritime," and Dr. J. N. McCormack will report upon the "Progress of Health Work in Kentucky." Dr. Peter H. Bryce, of the Provincial Board of Ontario, will report on "Small-pox in Canada, and the Methods of Dealing with it in the Different Provinces." The national reputation freely accorded the authors of these papers is a sufficient guaranty of their worth and character.

The Provincial Board of Quebec report that while their organization was called into existence to meet an emergency, yet it is the hope of the sanitarians of Montreal and the province that the provincial government will see fit to make their organization permanent.

Dr. G. G. Tyrrell, successor to Dr. Hatch, secretary of the State Board of Health of California, offers to do any special work in his section that may be assigned to him. Your committee would therefore respectfully submit his name for membership in this association.

Dr. George Homan reports that the State Board of Health of Missouri has been reorganized, with Mr. William Gentry, president, and Dr. Homan, of St. Louis, secretary, both being new members of the board. The reorganized board immediately addressed itself to inquiry and investigation regarding the condition of public hygiene in the state, and also to ascertaining the condition of live-stock—the board being charged by law with the duty of investigating diseases among domestic animals, as well as exercising general supervision over the health and sanitary interests of the citizens of the state. To the end of fulfilling the intent of the law creating it, a number of subjects presented, and deemed most important, were selected, and sub-committees of the board were appointed for their investigation:

1. Prevailing diseases among livestock; also, condition and care of stock-yards, cars, etc., at points of concentration or distribution.

2. The influential factors in the causation of endemic or epidemic diseases.

3. The source, quality, means of distribution, etc., of public water supplies in the state.

4. The sanitary care of railway and river transportation lines, including depots, landings, stations, wharf-boats, round-houses, passenger-cars, and sleeping-coaches.

5. Domestic and general sanitation in towns, villages, and country homes.

6. The condition of asylums, poor-houses, jails, work-houses, and other charitable or penal institutions, with reference to the health of the inmates.

7. The hygienic care of the school population, and of public school buildings and premises.

The date set for the completion of these reports is October 1, 1886, but preliminary statements of the work done have already been presented by Dr. Merrill and Dr. Cox—the latter submitting a very full report on the condition of public schools, buildings, etc., of the city of Springfield, and a part of Greene county, this state.

In the city of St. Louis, where a strong effort was made last spring and summer to effect the abolition of surface wells, and thus prevent the general use in families of polluted water, the influence of the board was exerted in furtherance of this much-needed sanitary reform, as the use of such water was deemed an invitation to cholera, which, if lodged here, would threaten with its disturbing and fatal presence the entire Mississippi valley.

The manufacture of soda-water from well-water in this city also received notice, and steps to discredit in the market goods of this class, emanating from such sources, have been advisedly taken.

The subject of how to most effectually protect the people of the state against small-pox has engaged the earnest attention of the board, and, as a means to this end, the matter of establishing a vaccine farm in connection with the Agricultural college of the State University at Columbia

is now under consideration both by the university authorities and by this board, with every prospect that the arrangement will soon be consummated, thereby guaranteeing to the people of the state a source of vaccine supply of superior quality, inasmuch as the element of gain or profit will not enter into the question of production; in this respect the enterprise having the advantage of those conducted by private producers. Another advantage will be the possession and use in this work of choice graded or blooded animals, as may be found best,—the work being in the immediate charge of Dr. Paquin, the state veterinarian. An ordinance regulating the preparation and transportation of the bodies of those dead of infectious or contagious diseases has been promulgated by the board, which is substantially the same as the rules now in force in the states of Illinois, Iowa, and Kansas, and which have been accepted by the express and other common carrier companies of those states. In this connection, and in view of the endeavor now being made to secure in this city a site for the erection of a crematory for the disposal of the dead by burning, and which project fails of a near fulfilment only because of unexpected opposition, it is the deliberate judgment of the executive committee of the board that the successful encounter and conquest of infectious disease besetting human population can be most surely and quickly achieved by joining with practical sanitary work for the removal of causes that favor the development of disease, this method of disposing of the remains of those dead of virulent maladies, in whose bodies or immediate belongings are to be found the potent and peculiar agents of the destroying specific infection.

It is deemed especially important that this method shall apply in dealing with the domestic infection of diphtheria, scarlet fever, etc., although the fact is fully recognized that in the present state of public feeling and opinion on this subject it would be inexpedient and premature to undertake to press the given opinion to embodiment in legislative enactments looking to the practical application of the suggestion in the direction indicated.

Dr. G. B. Thornton, of Memphis, Tenn., reports for the Mississippi valley, the sanitary condition of which has been very much improved; and the cordial relations that at present exist between state and local health authorities cannot be other than a source of great satisfaction to the members of the association.

Dr. Thornton says,—"The coöperation and mutual good feeling between the health organizations of the Mississippi valley were never better than at present. There exists now a better understanding between state boards of health of the relations toward each other, and the obligations resting upon each individually.

"As a result of the salutary change which was made within the past two years in the *personnel* of the Louisiana State Board of Health, the great reformations made in the public health administration of that state, with the disposition to coöperate with other state boards of health of the Mississippi valley, have created a confidence throughout the valley which

has never heretofore existed. All the states of the valley, with one or two exceptions, now have organized state boards of health and a number of local boards.

"Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Illinois, Missouri, Iowa, Wisconsin, West Virginia, and Indiana have efficient state boards, while Texas has no state board of health, but in lieu thereof has a very efficient state health officer, who acts for the state in all public health affairs. Alabama has a similar arrangement; and Ohio, that has no state board, has an auxiliary sanitary association, with an efficient secretary as health officer; and Cincinnati has a local board.

"The state boards indicated above are represented in the Mississippi Valley Sanitary Council, which holds an annual meeting at some agreed point, at which are discussed questions of mutual interest, and affecting the valley as a whole.

"These several organizations are now pledged to coöperate and give to each other prompt information upon all subjects affecting the public in which they have a common interest.

"The great reforms made by the Louisiana State Board of Health in the administration of its quarantine affairs, its improved inspection service and maritime sanitation, have worked very satisfactorily during the past summer.

"State boards of health, as well as a number of local boards of this section, are well organized, and, when occasion arises for increased vigilance and active practical work, will prove efficient conservators of the public health, and demonstrate their utility to their respective state governments, and the public health interests at large.

"No infectious disease has prevailed in this section this year. There has been no interruption to commerce or the ordinary interests of the country. It may be noted that the public generally are more appreciative of health organizations, and are becoming yearly more educated to the powers and good results of preventive medicine.

"The American Public Health Association is to be congratulated upon the influence it has exerted in bringing about these great reforms, which guarantee the greatest good to the greatest number."

Dr. Charles N. Hewitt reports that the State Board of Health of Minnesota desire to repeat the suggestion, already several times made, and to some extent adopted, that an association of state boards of health be perfected in accordance with the plan for such an organization submitted to the Conference meeting at St. Louis, October 13, 1884, as events have shown that such an association would now be of the greatest use.

While Massachusetts was so modest that neither papers nor suggestions were offered, yet your committee has good reason to believe that a great reform is being developed in health matters in that state, and that we may soon be able to congratulate the true friends of sanitation in the Old Bay State in declaring their independence of commissions of lunacy and charities, and once more assuming that exalted position among state health boards that was once given to that board under the leadership of Bowditch and the lamented Derby.

Ohio has no state board of health, and therefore will have no one to respond for her on the roll-call of states; and it is but an act of justice to the true, patriotic sanitarians of that prosperous commonwealth to recall their zeal in the organization of a voluntary association, whose object is the dissemination of sanitary knowledge among its citizens; and as "knowledge is power," and the education of the masses always brings out better thought and more intelligent appreciation of the dangers to be guarded against, we may reasonably hope that erelong, under such leaders as Ashman and Reed, Ohio will become a member of the conference of state boards of health.

A report will be made by Dr. Rauch, of Illinois, upon the condition of all the principal quarantine stations from the Gulf of St. Lawrence to the mouth of the Rio Grande. This report was made at the instance and expense of the State Board of Health of Illinois, for the purpose of ascertaining the protection that is afforded an inland state against the introduction of contagious diseases by immigration. As the report is based upon personal inspection of most of the stations, it will be a valuable paper to the association.

As our quarantine service is controlled by the several states, it is not an easy matter to get a full report of the several stations; and the thought is suggested, that, with the immense resources of the federal government, with money so plenty as to be worth only eighty-five per cent. of its face value, and of its guaranty to every person of certain inalienable rights, such as "life, liberty, and the pursuit of happiness," it is not a flattering evidence of national progression that in order to ascertain the actual condition of the chief quarantine stations of the United States it was necessary for an inland state to send its chief executive health officer on a tour of inspection.

That a direct tax should be laid on commerce to support our quarantine service may be a necessity, but it cannot be considered a proof of good statesmanship; but in this, as in other matters appertaining to the public health, let us hope that reforms will take place, and that ultimately, as sanitarians, we can say for humanity that it receives from the general government as much protection and care as is now freely bestowed upon savages on the plains, the fish in our lakes and rivers, and the cattle upon our prairies.

In conclusion, your committee would add that the following propositions have been adopted by the conference of state boards of health, and are to be submitted to the Executive Committee of the association:

1. That it is the judgment of your committee that in carrying out the object of their creation it is necessary to have a conference of delegates from state boards of health at least once a year, for the purpose of consultation, and to promote unity of action on matters essential to public health, the prevention of epidemics, and the most efficient means of instructing the people in sanitation.

2. Your committee would suggest that the most suitable occasion for holding this conference would be during the annual meeting of the

American Public Health Association, and that our President and Secretary arrange the time of the meeting in connection with the Executive Committee of the American Public Health Association so as best to promote the interests of the association and the conference.

3. Any conclusions of this conference that are of interest to the public shall be reported by the Secretary to the American Public Health Association through the Standing Committee on State Boards of Health.

G. P. Conn, M. D., *Chairman.*

REPORT OF THE COMMITTEE ON INCORPORATION.

I have been requested by the President of the Association, who is chairman of the Committee on Incorporation, to report as follows from that committee:

At the meeting in Detroit two years ago, a committee of which I was a member was appointed to ascertain what steps were necessary to effect the incorporation of the association under the laws of the United States in the District of Columbia. Last year that committee reported the requirements of the law in this matter, and recommended that if it was desired to effect the incorporation, a committee be appointed to represent the association in its corporate capacity; and that, as the law required a majority of the incorporators to be residents of the District, the committee should consist of the President, Treasurer, and Secretary of the association, and of four resident members. These recommendations were approved, and the committee which I now represent was appointed.

This committee met in Washington in December of last year, and drew up, signed, and recorded the articles of incorporation which are now submitted:—

CERTIFICATE OF INCORPORATION.

AMERICAN PUBLIC HEALTH ASSOCIATION.

We, the undersigned, members of the American Public Health Association, do certify that at the twelfth annual meeting of the association, held at St. Louis, Missouri, on the 14th-17th of October, 1884, a resolution was adopted and recorded in the minutes of the meeting authorizing us to draw up and file a certificate of incorporation on behalf of the association, in accordance with the requirements of the act approved April 23d, 1884, entitled "An Act to amend the Revised Statutes of the United States relating to the District of Columbia, and for other purposes."

That in accordance with said resolution, the following action has been taken:

The association which we represent shall be known in law as the American Public Health Association.

The said American Public Health Association is hereby organized for the term of one hundred years from the date of this certificate.

The objects of the American Public Health Association are the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene.

That the officers of the American Public Health Association consist of a President, First and Second Vice-Presidents, a Secretary, and a Treasurer; but that all disbursements and expenditures are made under the direction of an Executive Committee, which consists of the officers aforesaid and six members annually elected by ballot.

In testimony whereof, we have hereunto affixed our hands and seals this 11th day of December, 1884, at the city of Washington in the District of Columbia.

JAMES E. REEVES, *President.* [L. S.]
JOHN BERRIEN LINDSLEY, *Treasurer.* [L. S.]
IRVING A. WATSON, *Secretary.* [L. S.]
ALBERT L. GIHON, *Medical Director U. S. Navy*, [L. S.]
Washington, D. C.
CH. SMART, *Surgeon U. S. Army*, [L. S.]
Washington, D. C.
SMITH TOWNSHEND, [L. S.]
Washington, D. C.
SAM'L A. ROBINSON, [L. S.]
Washington, D. C.
JOHN EATON, [L. S.]
Washington, D. C.

DISTRICT OF COLUMBIA, } ss.
CITY OF WASHINGTON. }

On this 12th day of December, A. D. 1884, before me, a Notary Public in and for the District aforesaid, personally came James E. Reeves, President, John Berrien Lindsley, Treasurer, Irving A. Watson, Secretary, Albert L. Gihon, Medical Director U. S. Navy, Charles Smart, Surgeon U. S. Army, Smith Townshend, Samuel A. Robinson, and John Eaton, members of the American Public Health Association, to me well known to be the persons who signed and executed the foregoing instrument of writing, and acknowledged the same, individually, to be their act and deed, for the uses and purposes therein mentioned.

Witness my hand and notarial seal this 12th day of December, A. D. 1884.

GEORGE W. BAGG, [L. S.]
Notary Public.

10 A. M.

Received for record December 12, 1884, and recorded in Liber No. 3, folio 432, et seq., "Acts of Incorporation" for the District of Columbia.

Examined by
GEO. F. SCHAYER,
Dep. Recorder.

There remains to be said that the filing of this paper does not terminate the necessity for the continuance of this committee. It represents the association before the law. It must therefore be continued during the ninety-nine years of the term that has yet to run, if for no other purpose than to place on record the changes that take place in its own constitution. The law requires that all changes in the *personnel* of the incorporators be recorded in the office of the recorder of deeds. We change our President annually, and annually other changes may be necessary in the composition of this incorporation committee. These will require to be recorded. An affidavit by one of the members of the committee, as, for instance, by the Secretary of the Association, conveying a notice of the annual changes, will fulfil this requirement. Should the change affect the Secretary, the affidavit of any of the members who are carried over from a previous year will answer the purpose.

CH. SMART.

REPORT OF THE COMMITTEE ON SCHOOL HYGIENE.

[This report being somewhat incomplete at the time it was rendered, the chairman, Prof. D. A. Sargent, has requested its omission in this volume. A more complete report will be presented at the Toronto meeting in October.—SECRETARY.]

REPORT OF THE COMMITTEE ON NECROLOGY.[1]

TO THE PRESIDENT AND MEMBERS OF THE ASSOCIATION:—

Your committee beg leave to submit the following report upon our deceased associates:

JOHN JAMES SPEED, M.D., of Louisville, Ky., was born near Bardstown, Nelson county, Ky., Oct. 31, 1816, and having received his preparatory education at St. Joseph's college, Bardstown, he graduated from the medical department of the Transylvania University in 1838. He was located at Crawfordsville, Ind., for a few years, and afterwards at Bardstown, Ky., until 1850, when he removed to Louisville, and at once entered upon the active duties of his profession.

For several years Dr. Speed was secretary of the state board of health, and his energy and skill were largely instrumental in making that organization effective in its work. He recognized and appreciated the vital importance of such a body, and with commendable courage set about to make it successful. Dr. Speed was appointed postmaster at Louisville in 1861, and remained in the office for eight years.

[1] Report made by Dr. G. P. Conn, Concord, N. H., for the committee.

A friend, in describing his work in sanitation, says,—"With Parkes he accepted hygiene in its largest sense, signifying rules for the perfect culture of both mind and body, training the body, intellect, and the moral faculties in a perfect and balanced order. These finished and classical lectures upon the subject of public hygiene have done much toward earning the fame this institution has attained among the best medical colleges of the land. His work in this department was by no means confined to this sphere. He was an esteemed and honored member of the American Public Health Association, and other bodies devoting themselves to sanitary science, in all of them occupying a prominent place, and in some of them the highest seat of honor."

Dr. Speed was Professor of Hygiene and the Institutes of Medicine in the Hospital College of Medicine, and a meeting of its faculty was immediately called to take into consideration his death. Resolutions were adopted expressive of their regret at his loss, and eulogizing his ability as a teacher, writer, and physician, and his character as a man. His death occurred May 6, 1885.

Prof. Richard McSherry, M.D., LL.D., of Baltimore, Md., was born at Martinsburg, W. Va., November 21, 1817. He received his classical education in Georgetown college, and studied medicine in the University of Pennsylvania, where he received his degree of M.D. in 1841. He entered the medical corps of the army early in life, and served under General Taylor in the Seminole war. Leaving the army in 1843 he entered the navy, where he remained for nine years, serving in the East and West Indies, North and South America, and making a cruise round the world in the old "Constitution." In General Scott's campaign in Mexico he served as surgeon to a battalion of marines. He resigned from the navy in 1851 and went to Baltimore, where he established a practice which continued until his last illness. He was elected Professor of Materia Medica and Therapeutics in the University of Maryland in 1863, which chair he filled until 1865, when, upon the death of Professor Samuel Chew, he was made Professor of Principles and Practice of Medicine. He was president of the Medical and Chirurgical Faculty of Maryland in 1883, and was one of the founders and the first president of the Baltimore Academy of Medicine. At the time of his death he was president of the Maryland State Board of Health. Dr. McSherry was a writer of no ordinary ability, and his varied experience gave him ample opportunity for the use of his talent. During the earlier part of his career he wrote much on surgical subjects, but his later articles are more generally upon the topics of practical medicine and sanitary science. He continued until within a few months of his death to be a contributor to the pages of our best medical and sanitary journals.

We are rarely called upon to chronicle the death of any one whose loss is so universally felt and deeply regretted as that of Dr. McSherry. He was the representative of all that is cultivated, dignified, and honorable in the medical profession, and combined in an unusual manner the skill,

experience, and learning of the physician, with the tact, grace, and amiability of the gentleman. To the wealth of information, derived from a life of study, he added large stores of practical experience gathered in many parts of the earth as army and navy surgeon, as well as in an extensive practice in Baltimore. His lectures were clear, concise, and practical, not unfrequently adorned with apt classical quotation, or seasoned with crisp, humorous anecdote.

He was particularly kind and considerate towards the younger members of the profession; and while he always had the courage of his convictions, no one who knew him ever entered the consultation-room with him in the fear of any of those unmanly methods which sometimes make consultations odious. He was always fair and honorable, and a meeting with him was often of as much advantage to the doctor as to the patient.

Dr. Van Sinderen Lindsley, M. D., died at his residence, No. 50 South Spruce street, Nashville, Tenn., on Sunday, November 15, 1885. This announcement grieved the entire community of Nashville, and a large circle of friends extending over many states. For twenty-five years Dr. Lindsley had lived in their midst, and his name and fame were familiar to all. His life has been one of activity and constant usefulness, and peculiarly identified with public interests.

As a laborious and learned medical educator Dr. Lindsley was widely known. He was drawn very near to the hearts of the people as a skilled and faithful practitioner, and a fearless worker throughout the terrible epidemics which have devastated Nashville since the war, giving his services as freely to the poor for their blessing as to the rich for their reward.

Van Sinderen Lindsley was born at Greensborough, North Carolina, October 30, 1840. His father was Silas Condict Lindsley, a native of Morristown, New Jersey, and graduate of Princeton college, and a distinguished educator of that state. His mother was Amelia Spottiswood, of Pennsylvania, a woman of great piety and noble Christian character. His uncles were Dr. Philip Lindsley, founder and president of Nashville University, and Dr. Harvey Lindsley, of Washington, D. C.

The family descends from John Lindsley, one of the earliest English settlers of the New Haven colony, Connecticut, who came from London before 1640. Dr. Lindsley's ancestry shows an American record of eight generations, embracing a period of two hundred and forty years.

Primarily educated at Greensborough Institute, of which his father was principal, he was graduated A. M. at the University of Nashville in 1861, and in 1863 received the degree of M. D. from its medical department, by whose faculty he was subsequently elected demonstrator of anatomy. Step by step he advanced until successively he filled the chairs of surgical anatomy, physiology, and anatomy. In 1875 he was elected to the chair of opthalmology and otology. His profound knowledge of the human system, its mechanism and all its functions, combined with a fearless boldness in operating and a rare delicacy of manipulation,

led the faculty to unanimously entrust this highly scientific and difficult chair to him, though its youngest member.

A few years have sufficed to make him known most favorably among scientists, and among patients to give him a national reputation and a large and lucrative practice. He contributed regularly to medical literature, his papers always attracting marked attention at the time, and were widely noticed and copied.

He was elected and reëlected president of the Nashville Medical Society, was a member of the American Association for the Advancement of Science, was a member of the American Medical Association, and was a delegate to New York in 1880 and to New Orleans in 1885; was a delegate from the State Medical Society to the International Congress held in Philadelphia in 1876, was a member of the State Historical Society and of the American Public Health Association.

Magnanimity was a distinguishing trait of his character. In the controversies which official position or a sense of duty compelled him to engage he was always the sturdy champion of principles, and harbored no ill-will to his opponents, always feeling that they were actuated by expediency rather than from personal motives. He was a public-spirited citizen, aiding in all worthy public enterprises, and the dispenser of liberal charity, contributing to public and private need with a large-hearted generosity.

Admirable in public life, Dr. Lindsley was lovely in the home circle. In April, 1868, he married Lucy, daughter of Pay Director J. George Harris, U. S. N., and Lucy McGarock, of Nashville, at Harvard Street church, Charlestown, Mass. This proved a most happy union, in which he displayed those charming attributes of Christian gentleness and love which sometimes give mortals a glimpse of angelic existence and heavenly peace. His wife, an only daughter, Joy Lindsley, and three sons, Harris, Van Sinderen, and Joseph, mourn his irreparable loss. He was truly a devoted husband, and a tender, loving father.

Dr. Lindsley, assisted by his beloved wife, delighted in gathering his friends, both in and out of the profession, about him in his hospitable mansion, where they enjoyed a refined, graceful hospitality.

His life, so busy, so conspicuous, had covered a period of but forty-five years. It was brief, but fruitful. Just at the prime of mental and physical vigor, trained by a long course of study both in the literature and the practice of his profession, his career was arrested. He accomplished much, but his life was opening for higher achievements. What he was we know, and a continued career would have carried in its train increasing honor. He died of acute inflammatory rheumatism, which after a few weeks' illness terminated his earthly career.

Henry Partridge Strong, M. D., of Beloit, Wis., was born in Brownington, Vt., February 8, 1832, and died in Beloit, June 20, 1883. He graduated in medicine at the medical college in Castleton, Vt., in 1853, and very soon located in Beloit, where he always remained except

for a period of service in the army from 1861 to 1863. He was connected with the 11th Regiment Wisconsin Volunteers as assistant-surgeon, and afterwards became surgeon-in-chief of the 14th Division, 13th Army Corps, a position which he held until he felt compelled to resign by reason of physical disability occasioned by overwork. Dr. Strong was a prominent member of several medical associations beside the American Public Health Association, and a member of the Wisconsin State Board of Health. He was an active member of society, and took part in all the great questions of the day. After his service in the army he was elected mayor of Beloit five times, and was for eight years postmaster of the city. He was married in 1857 to Sarah M., daughter of Rev. Dexter Clay.

Frederick Winslow Hatch, M. D., of Sacramento, Cal., was born in Charlottesville, Va., March 2, 1822, and died in Sacramento, Oct. 16, 1884. He was a graduate of Union college, N. Y., and of the medical department of New York University in 1843. He first located in Wisconsin, but removed to Sacramento in 1851. He was greatly esteemed by the people of California, and enjoyed the confidence of the profession of the Pacific slope, as he was for a long time a professor in the medical department of the University of California. He was elected Secretary of the State Board of Health of California in 1876, on the death of the late Thomas Logan.

John Woodbury Sawyer, M. D., superintendent of the Butler Hospital for the Insane, died after a brief illness, on Monday, December 14, 1885, at the age of fifty-one years. He was born in Danvers, Mass., November 5, 1834, and received his medical education at Harvard University, where he graduated as doctor of medicine in 1858. He was immediately, by the selection of Dr. Ray, appointed to the office of assistant physician in this hospital, and here he spent the first two years of his professional life. He then entered upon the practice of his profession in Boston, and after the lapse of a little more than a year he was appointed assistant superintendent of the state hospital for the insane at Madison, Wis. He had been engaged in discharging the duties of that position for nearly six years, when, on the resignation of the late Dr. Isaac Ray, he was chosen superintendent of this hospital, and entered upon the duties of the office in January, 1867. The choice was made in accordance with the recommendation of Dr. Ray, who had had charge of the hospital from its foundation.

From the day of his election to the day of his death, a period of nearly nineteen years, he has discharged the diversified duties of this office with unremitting assiduity, with rare wisdom, and with distinguished success. Under his watchful superintendence, and by his wise administration, the hospital has widened the sphere of its usefulness and improved its methods of sanitary treatment; its resources and its provision for the care and comfort of its patients have been greatly enlarged; it has thus

acquired new titles to public confidence and esteem, and has secured new friends in the new generation which has arisen since it was founded. In February, 1871, he married Mary Elizabeth Proctor, of Danvers, Mass.

Peter V. Schenck, M.D., was born May 23, 1838, in Somerset county, New Jersey, and died in St. Louis, March 11, 1885. He was a direct descendant of the Van Schenck family that came from Holland in 1650, and settled on Long Island. He received his academic education at Princeton college, and graduated M. D. from the University of Pennsylvania. He entered the U. S. A. May 28, 1861, and for faithful and meritorious services during the war was brevetted captain and major U. S. A., March 13, 1865. He resigned January 1, 1867, and for twenty years was an active member of the Legion of Honor.

He was always an enthusiast on the subject of sanitation, and while health officer of St. Louis contributed a series of articles on sanitary topics, which were published in the *Globe* and *Republican*, and at the time of his death he had in preparation an article which he intended to read before this Association. He became a successful practitioner, devoting much of his time to gynecology and obstetrics, and was honored with a chair in the Missouri Medical College. He was an honored member and correspondent of a large number of medical organizations.

James Gray Thomas, M.D., was born near Bloomfield, Ky., June 24, 1835; was educated at the Bloomfield high school and at St. Joseph college, Bardstown, Ky. He commenced his medical studies in Louisville, Ky., and graduated from the University of New York in 1856. During the next four years he was located in his native town in Kentucky, and during the war was a surgeon in the confederate service. In 1865 he removed to Savannah, Ga., and at once took a prominent position in the profession, and was beloved by all his friends and patrons.

He was ever ready and willing to do the work that pressed upon him, and would often turn aside from the congenial occupations of home life if the claim only addressed itself to his keen sense of public duty. It is therefore no wonder to those who knew him best that he was a thorough sanitarian, and that his services in the cause of hygiene will serve to enroll his name upon the banner of state medicine, and rank him as a benefactor of his own state, and with the annals of sanitation throughout our entire land.

He died in the city of Washington, December 6, 1884. A notice of his life and character would not be complete without some reference to his standard of high moral character, which has been so beautifully expressed by his friend and biographer, Dr. Agnew, that I cannot forbear quoting from the closing paragraphs of his address in memoriam of Dr. Thomas:

"It is a source of joy and inexpressible satisfaction that there are so many good and true men in the medical profession of the United States.

The whole fraternity may well join in thankfulness that the career of Dr. Thomas, among his colleagues, neighbors, and friends, was blessed as it was to his family, his patients, and the state; that he attempted with so much modesty and unflinching purpose to realize in his daily work and in his public services so high an ideal, and that his last professional act, in the performance of which he gave his life, included the grand idea of the brotherhood of nations and the community of science and benevolence. From those who knew him well the source of the power in his life was not hidden; it sprung perpetually from an humble belief, not only in the supernatural, but in a personal, triune God, upon whose mercy he had cast himself, and whose law he strove to know, to love, and to obey."

Dr. John Ten Brook, of Paris, Ill., died August 8, 1885, aged 77 years. He became a member of the American Public Health Association in 1880. He was quiet and unobtrusive in his habits of life, an active and intelligent practitioner of medicine, deeply interested in the prevention of disease, and an excellent and worthy citizen. He died honored and respected by all who knew him.

Thaddeus M. Stevens, M. D., of Indianapolis, Ind., was born in that city, August 29, 1830. His education was commenced in Indiana, and he graduated at the University of Pennsylvania in 1853, and soon after located in Indianapolis. He made a specialty of chemistry, and was for a considerable time connected with the Indiana *Journal of Medicine*, and afterwards with the *Lancet* and *Observer*. He also at one time had a chair in one or more of the medical colleges of Indianapolis. He was an enthusiast upon the subject of state medicine, and labored unceasingly in his native state until a state board of health was secured. He was elected its first Secretary, and in that capacity did much effective work for the cause of hygiene in Indiana. He became a member of this association in 1875, and up to the time of his death was always prompt in doing any duties that were assigned to him, and was a constant attendant upon our meetings.

Washington Caruthers Kerr, Ph. D., the second president of the Mitchell Society, died in Asheville, N. C., August 9, 1885, at the age of fifty-six years. He was born in Guilford county, N. C., and was graduated at the University of North Carolina, with highest honors in scholarship, in 1850. After teaching school in North Carolina, and while a professor in Marshall University, Texas, he was appointed a computer in the Nautical Almanac office at Cambridge, Mass. Availing himself with great ardor of the opportunities offered by Harvard college, he became the companion as well as the pupil of Davis, and Agassiz, and Peirce, and Lovering, and Guyot, and Horsford, and Eustis, and formed lasting friendships with others renowned in science on both sides of the Atlantic. From Cambridge he went, in 1857, to Davidson college, N. C., as its Professor of Chemistry, Geology and Mineralogy. This

position of personal safety he left at the beginning of the late civil war, and enlisted as a private in the Confederate army, but was soon detailed to devise methods for, and to superintend, the manufacture of salt on the coasts of North Carolina and of South Carolina. In 1866 he became the successor of Dr. Emmons as the geologist of North Carolina. In 1867–'8 he delivered the lectures on Chemistry, Geology, and Mineralogy before the senior class at the University of North Carolina. In 1882 he accepted a position in the Coast Survey of the United States, that he might connect his own work in North Carolina with that of the nation. His labors among the mountains of North Carolina were suspended, because of bodily infirmity, in 1883.

Dr. Kerr was one of the oldest and most active members of the American Association for the Advance of Science, the American Public Health Association, and was connected with several other similar societies. To the archives and to the publications of these bodies he contributed frequently and often largely. Although of a slight physical frame, he was of great energy in body and in mind. He visited every portion of his native state, and examined personally its plains, hills, mountains, rivers, creeks, forests, minerals, metals, and climate. No man has ever labored so constantly, intelligently, lovingly, and successfully to discover and proclaim the capability of North Carolina to supply the wants of mankind. Possessed of a fluent tongue and a ready pen, he spread the fame of his state wherever science is cultivated.

Thomas L. Neal, M. D., died at Dayton, Ohio, February 13, 1885, after a lingering illness of over a year. He was born in Mechanicsburg, Ohio, September 9, 1830, and studied medicine with Dr. Conklin, Sr., at Sidney, afterwards graduating from the Miami Medical College. He entered into partnership with Dr. Conklin at Sidney, and practised there about five years, when he removed to Cincinnati. At the outbreak of the civil war he enlisted in the service, and was engaged in hospital work for some time. At the urgent request and petition of the members of the Second Virginia Cavalry he was assigned as their surgeon, but held the position for a short time, when he was detailed for hospital service at Charleston, Pt. Pleasant, and Clarksburg, W. Va. At each of these places he had charge of large hospitals of about sixty men each. In 1863 he resigned his position in the army and went to Dayton. In 1868 he was appointed the health officer of that city, and ably filled this position for sixteen years. He was at various times president of the Montgomery County Medical Society, and was also for a number of years a member of the Executive Committee of the American Public Health Association. He was one of the ablest of the profession in his city, and particularly interested himself in sanitary matters, which he had made almost a life study. During long service as a public officer he was faithful and energetic in the performance of his duty. As a physician, to his professional brethren he was courteous and honorable; to his patients, kind and attentive. He was a conscientious adviser and counsellor of more than

ordinary ability. As a man, he was quiet and dignified, elevated in sentiment, and honest in all his actions.

The following is an extract from the resolutions adopted by the Board of Health of Dayton upon his death :

"During sixteen years of his most vigorous manhood he performed the duties of a health officer. In his long official capacity he was ever active and energetic in his work, and he always conducted his labor with such care, wisdom, and efficiency as not only to elicit the commendation of the members of this board, but that of the people generally. Upon his wisdom, activity, and perseverance the board of health has developed to its present standing and usefulness ;—hence his memory is entitled to the unrestricted gratitude of every resident of the city. As an executive officer, he was patient, courteous, and genteel, and as a sanatarian, thorough and complete. In his death, therefore, the sanitary department of Dayton, as well as that of the nation, loses a most competent adviser and interested worker."

ANNUAL REPORT OF DR. J. BERRIEN LINDSLEY,

Of Nashville, Tennessee, Treasurer of the American Public Health Association, December 8, 1885.

RECEIPTS.

Balance brought forward	$1,245 53	
From sale of *Public Health*	262 60	
From anuual fees of members	1,830 00	
Total		$3,338 13

DISBURSEMENTS.

Paid for printing, binding, and distributing Vol. X of *Public Health*	$1,546 37	
Paid President's postage and stationery for two years	79 00	
Paid Secretary's postage, printing, stationery, and help	202 30	
Paid Treasurer's postage and help	73 63	
Paid Secretary's travelling expenses	119 10	
Paid Treasurer's travelling expenses	86 20	
Paid for advertising the Lomb essays	76 25	
Paid expenses of incorporation	10 25	
Paid Committee on Disinfectants	50 00	
Total		2,243 10
Balance cash on hand		$1,095 03

The above expenditures were ordered by the Executive Committee, and vouchers for the same are herewith submitted.

J. BERRIEN LINDSLEY,
Treasurer A. P. H. A.

WASHINGTON, D. C., December 12, 1885.

To the President American Public Health Association:—

Sir:—The undersigned, an Auditing Committee appointed to audit the Treasurer's account for the year ending Dec. 8, 1885, respectfully report that they have examined the vouchers, and find the same correct.

Respectfully submitted,

THOMAS F. WOOD.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This Association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECTS.

II. The objects of this Association shall be the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene.

MEMBERS.

III. The members of this Association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanent body of the Association, subject to the provisions of the constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in or devotion to sanitary studies and allied sciences, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the Association, but shall not be entitled to vote.

Delegates from national, state, provincial, and municipal boards of health, organized sanitary associations, and the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee. Members, not delegates from such bodies shall be elected as follows :—

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession and special qualifications of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at a regular meeting, the candidate shall be declared duly elected a member of the Association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and Second Vice-President, a Secretary, and a Treasurer.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or in his absence, one of the Vice-Presidents, or in their absence, a Chairman *pro tempore*, shall preside at all meetings of the Association. He shall preserve order, and shall decide all questions of order, subject to appeal to the Association. He shall also appoint all committees authorized by the Association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the Association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the Association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the Association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the Association; and shall give notice to the several officers, and to the Executive and other Committees, of all votes, orders, resolves, and proceedings of the Association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the Association. Out of these funds he shall pay such sums only as may be ordered by the Association, or by the Executive Committee. He shall keep a true account of his receipts and payments; and, at each annual meeting, render the same to the Association, when a committee shall be appointed to audit his accounts. If from the annual report of the Treasurer there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the Association, until such balance shall be paid.

STANDING COMMITTEES.

VIII. There shall be the following standing committees: (1) The Executive Committee, (2) the Advisory Council, (3) the Committee on Publication.

EXECUTIVE COMMITTEE.

IX. The Executive Committee shall consist (1) of the President, First Vice-President, Second Vice-President, Secretary, and Treasurer; (2) of six active members, of whom three shall be elected annually by ballot, to

serve two years, and who shall be ineligible to reëlection for a second successive term; and (3) of the ex-Presidents of the Association.

It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the Association; to authorize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and, at the regular meetings, report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the Association, and execute all such duties as may, from time to time, be committed to them by the Association. At least one month preceding the annual meeting of the Association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the Association; and such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented, and the special points of discussion.

ADVISORY COUNCIL.

X. The Advisory Council shall consist of one member from each State, Territory, and District, the Army, Navy, and Marine Hospital Service, the Dominion of Canada, and each of the Provinces, who shall be appointed by the President on the last day of each session, and who, besides acting as a nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the Association as shall best secure the objects of the Association. They shall at their first meeting elect from their own number a Secretary, whose record of their proceedings shall be made part of the records of the Association.

COMMITTEE ON PUBLICATION.

XI. The Committee on Publication shall consist of the Secretary and two active members, selected by the Executive Committee, who shall contract for, arrange, and publish, under authority of the Executive Committee, the proceedings of the Association, including such papers as have been examined and approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

REPORTS AND PAPERS.

XII. All committees, and all members preparing scientific reports or papers to be laid before the Association at its annual meetings, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least one week preceding the date of such meeting, to secure their announcement in the order of business.

MEETINGS.

XIII. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of By-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the Association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular, to all the members, together with the order of business.

QUORUM.

XIV. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the Constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XV. The order of business at all meetings of the Association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION.

XVI. No alteration in the Constitution of the Association shall be made except at an annual meeting, nor unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

BY-LAWS OF THE EXECUTIVE COMMITTEE.

QUORUM.

1. Five members shall constitute a quorum for the transaction of such business as may come before the committee.

MEMBERS RESTRICTED.

2. No elective member of the Executive Committee shall be at the same time a member of the Advisory Council, if there is another member of the association from his state or service.

PARLIAMENTARY USAGE.

3. Cushing's Law and Practice of Legislative Assemblies shall be the guide of parliamentary practice until otherwise ordered.

PAPERS.

4. All papers presented to the association must be either printed, typewritten, or in plain handwriting, and be in the hands of the Secretary at least twenty days prior to the annual meeting, to insure their critical examination as to their fulfilling the requirements of the association.

5. If any paper is too late for critical examination, said paper may be so far passed upon by the Executive Committee as to allow its reading, but such paper shall be subject to publication or non-publication as the Executive Committee deem expedient.

6. All papers accepted by the association, whether read in full, by abstract, by title, or filed, shall be delivered to the Secretary as soon as thus disposed of, as the exclusive property of the association. Any paper presented to this association and accepted by it shall be refused publication in the transactions of the association if it be published in whole or in part by permission or assent of its author in any manner prior to the publication of the volume of transactions, unless written consent is obtained from the Publication Committee.

7. Day papers shall be limited to twenty minutes, and evening papers to thirty minutes, each.

DISCUSSION OF PAPERS.

8. After the leading papers on each subject, as indicated by the Executive Committee, have been read, discussion shall follow, and be confined strictly to the subject of these papers; and each speaker shall be limited

to ten minutes, and shall not speak a second time until after every other member who desires to be heard, and then only for five minutes, except by unanimous consent.

9. The Chair shall notify gentlemen who desire to speak to send up their names, and they shall be called on in the order sent up, and he may, at his discretion, limit the time of speaking to five instead of ten minutes, if in his judgment it may become necessary to do so in order to allow each one on the list an opportunity to be heard.

PUBLICATION COMMITTEE.

10. The Committee on Publication, charged with the duties of selecting and printing the papers and transactions of the association, shall consist of three active members of the association, and of whom one shall be the Secretary, appointed by the Executive Committee during the session of the association, and selected with reference to their facilities of meeting.

11. All papers read by title, and others not definitely passed upon by the Executive Committee, shall be referred to the Publication Committee for critical examination; and said committee is authorized to reject such papers as in its judgment are not worthy of publication, and to omit such others as cannot be included within the limits of the annual volume.

12. The Publication Committee shall procure a copyright on the transactions in the name of the association, and the committee shall have full charge of the publication of the transactions.

APPLICATION FOR MEMBERSHIP.

13. All applications for membership must be made upon the application blank of the association.

14. Persons not members, having prepared papers to be presented at the meetings of the association, shall be proposed for membership at the first business session of the association.

EXPENDITURES.

15. All bills connected with the publication of the transactions shall, upon the approval of the chairman of the Publication Committee and the Secretary, be signed by the President of the association, and paid by check of the Treasurer directly to the party concerned; and the President shall not approve any bill relating either to publishing or printing without the approval first of the chairman of the committee in charge thereof.

16. Bills for current expenses shall be first approved by the Secretary, then sent to the President, and on his approval they shall be paid by check of Treasurer directly to the parties interested.

17. The actual and necessary travelling expenses of the Secretary and Treasurer to the annual meeting of the association, and to one meeting of the Executive Committee, shall be classed as current expenses.

RESOLUTIONS.

18. All resolutions presented to the association shall be sent to the Chair in writing, and referred to a committee without discussion.

ARREARAGES.

19. The arrearages of all members remitting their dues for two years shall be cancelled up to the date of the last payment, but they shall be entitled to the transactions of the association only for the years for which they have actually paid.

AUDITING COMMITTEE.

20. An Auditing Committee shall be appointed by the Chair to audit the accounts of the Treasurer, and report upon the same.

OFFICERS AND COMMITTEES

—OF THE—

AMERICAN PUBLIC HEALTH ASSOCIATION.

ORGANIZATION, 1885–1886.

President, . . .	Dr. HENRY P. WALCOTT, .	*Cambridge, Mass.*
First Vice-President, .	Dr. CHARLES W. COVERNTON, .	*Toronto, Ont.*
Second Vice-President, .	Dr. G. B. THORNTON, .	. *Memphis, Tenn.*
Secretary, . . .	Dr. IRVING A. WATSON, .	. *Concord, N. H.*
Treasurer, . . .	Dr. J. BERRIEN LINDSLEY, .	. *Nashville, Tenn.*

(*Ex-officio* Members Executive Committee.)

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

(Elective.)

Major CHARLES SMART, U. S. A.	*Washington, D. C.*
Dr. HENRY B. BAKER	*Lansing, Mich.*
Dr. PINCKNEY THOMPSON	*Henderson, Ky.*
Prof. HOSMER A. JOHNSON	*Chicago, Ill.*
Dr. JOSEPH HOLT	*New Orleans, La.*
Prof. CHARLES N. HEWITT	*Red Wing, Minn.*

(The ex-Presidents. *ex-officio* members Executive Committee.)

Dr. STEPHEN SMITH	*New York city.*
Dr. JOSEPH M. TONER	*Washington, D. C.*
Dr. EDWIN M. SNOW	*Providence, R. I.*
Dr. JOHN H. RAUCH	*Springfield, Ill.*
Prof. JAMES L. CABELL	*University of Virginia, Va.*
Dr. JOHN S. BILLINGS	*U. S. Army.*
Prof. ROBERT C. KEDZIE	*Lansing, Mich.*
Dr. EZRA M. HUNT	*Trenton, N. J.*
Dr. ALBERT L. GIHON	*U. S. Navy.*
Dr. JAMES E. REEVES	*Wheeling, W. Va.*

ADVISORY COUNCIL.

THE PRESIDENT, *ex-officio*.

Alabama, . . .	Dr. JEROME COCHRAN, *Mobile.*
Arkansas, . . .	Dr. H. C. DUNAVANT, *Osceola.*
California, . .	Dr. G. G. TYRRELL, *Sacramento.*
Colorado, . . .	Dr. CHARLES AMBROOK, *Boulder.*
Connecticut, . .	Prof. C. A. LINDSLEY, *New Haven.*
Delaware, . . .	Dr. L. P. BUSH, *Wilmington.*

Florida, . . .	Dr. ROBERT B. S. HARGIS, *Pensacola.*
Georgia, . . .	Dr. W. H. ELLIOTT, *Savannah.*
Illinois, . . .	Dr. JOHN H. RAUCH, *Springfield.*
Indiana, . . .	Dr. C. N. METCALF, *Indianapolis.*
Iowa, . . .	Dr. J. F. KENNEDY, *Des Moines.*
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Dr. C. G. COMEGYS	Cincinnati, Ohio.	1884.
Dr. T. GRISWOLD COMSTOCK	St. Louis, Mo.	1884.
Dr. J. W. COMPTON	Evansville, Ind.	1879.
Dr. W. B. CONERY	St. Louis, Mo.	1882.
Dr. GRANVILLE P. CONN	Concord, N. H.	1875.
Prof. PHINEAS S. CONNER	Cincinnati, Ohio.	1884.
Dr. LAERTES CONNOR	Detroit, Mich.	1883.
Dr. W. C. COOK	Nashville, Tenn.	1884.
Hon. W. F. COOPER	Nashville, Tenn.	1884.
JOHN P. CORCORAN	Linden, Mich.	1883.
Prof. H. B. CORNWALL	Princeton, N. J.	1884.
Dr. CHARLES WM. COVERNTON	Toronto, Canada.	1884.
Dr. GEORGE M. COX	Springfield, Mo.	1884.
Dr. G. G. CRAIG	Rock Island, Ill.	1880.
Dr. J. W. CRAIG	Mansfield, Ohio.	1884.
Dr. S. C. CRAVENS	Bloomfield, Ind.	1882.
Hon. THOMAS T. CRITTENDEN	Jefferson City, Mo.	1884.
J. JAMES R. CROES, C. E.	Yonkers, N. Y.	1877.
Dr. WM. CUNNIFF	Toronto, Canada.	1883.
Dr. DAVID M. CURRIER	Newport, N. H.	1883.
Prof. F. C. CURTIS	Albany, N. Y.	1883.
Prof. CHARLES O. CURTMAN	St. Louis, Mo.	1884.
Dr. JACOB M. DACOSTA	Philadelphia, Penn.	1874.
Dr. J. P. DAKE	Nashville, Tenn.	1879.
Dr. N. PENDLETON DANDRIDGE	Cincinnati, Ohio.	1884.
Dr. F. E. DANIEL	Austin, Texas.	1880.
Dr. H. H. DARR	Caldwell, Texas.	1883.
Dr. JAMES DARRACH	Germantown, Penn.	1874.
Dr. BENNETT F. DAVENPORT	Boston, Mass.	1884.
Dr. WILLIAM B. DAVIS	Cincinnati, Ohio.	1884.
Dr. WALTER DEFOREST DAY	New York city.	1873.
Dr. D. V. DEAN	St. Louis, Mo.	1880.
Dr. F. F. DEDECKY	Sacramento, Cal.	1882.

Dr. Giovanni Dell Orto	New Orleans, La.	1880.
Dr. Laben Dennis	Newark, N. J.	1877.
Dr. John W. Detwiller	Bethlehem, Penn.	1882.
Dr. Gustavus Devron	New Orleans, La.	1878.
Dr. Oscar C. DeWolf	Chicago, Ill.	1880.
Dr. W. H. Dickerson	Des Moines, Iowa.	1881.
Hon. Perez Dickinson	Knoxville, Tenn.	1881.
Dr. William Dickinson	St. Louis, Mo.	1884.
Dr. C. E. Diven	Anderson, Ind.	1884.
William E. Dodge, Jr.	New York city.	1874.
Prof. Frank Donaldson	Baltimore, Md.	1875.
Dr. Abram Dubois	New York city.	1874.
Dr. John E. Duffel	Donaldsonville, La.	1880.
Dr. John A. Dulaney	Covington, Ky.	1884.
Dr. T. C. Duncan	Chicago, Ill.	1880.
Dr. H. C. Dunnavant	Osceola, Ark.	1882.
William P. Dunwoody	Washington, D. C.	1884.
Dr. Samuel H. Durgin	Boston, Mass.	1875.
Dr. O. R. Early	Columbus, Ky.	1879.
Prof. L. Eddy	Danville, Ky.	1884.
Dr. Joseph F. Edwards	Philadelphia, Penn.	1884.
Dr. E. R. Eggleston	Mt. Vernon, Ohio.	1882.
Dr. E. S. Elder	Indianapolis, Ind.	1882.
Dr. John B. Elliott	Sewanee, Tenn.	1880.
Dr. William H. Elliott	Savannah, Ga.	1878.
Dr. Justin E. Emerson	Detroit, Mich.	1883.
Dr. George J. Engelmann	St. Louis, Mo.	1884.
Dr. D. C. English	New Brunswick, N. J.	1882.
Dr. George Engs	Newport, R. I.	1876.
Dr. S. T. Evans	Union City, Tenn.	1880.
Dr. William J. Evans	New York city.	1884.
Dr. Henry C. Fairbank	Flint, Mich.	1880.
Dr. L. A. Falligant	Savannah, Ga.	1881.
J. T. Fanning, C. E.	Manchester, N. H.	1884.
A. B. Farquhar, Esq.	York, Penn.	1880.
Dr. John Fee	Kansas City, Mo.	1884.
Edward Fenner, Esq.	New Orleans, La.	1879.
Dr. Thomas H. Fenton	Philadelphia, Pa.	1884.
Hon. John C. Ferris	Nashville, Tenn.	1884.
Dr. C. S. D. Fessenden, U. S. M. H. S.	St. Louis, Mo.	1884.
Dr. J. D. Fields	Manor, Texas.	1880.
Dr. N. Fields	Jeffersonville, Ind.	1884.
Dr. W. E. Fischel	St. Louis, Mo.	1884.
Dr. Charles H. Fisher	Providence, R. I.	1881.
L. C. Fisher, Esq.	Galveston, Texas.	1878.
Dr. George W. Foote	Galesburg, Ill.	1877.
Prof. Corydon L. Ford	Ann Arbor, Mich.	1872.
Dr. William H. Ford	Philadelphia, Penn.	1874.
Dr. Felix Formento	New Orleans, La.	1880.
Dr. Eugene Foster	Augusta, Ga.	1881.
Dr. H. D. Fraser	Charleston, S. C.	1880.

Dr. William Freeman	Vevay, Ind.	1884.
Dr. George F. French	Minneapolis, Minn.	1875.
Dr. A. G. Friedrichs	New Orleans, La.	1880.
Dr. Frank R. Fry	St. Louis, Mo.	1884.
Dr. Robert M. Funkhouse	St. Louis, Mo.	1884.
Prof. James T. Gardner	Albany, N. Y.	1875.
Dr. J. D. Gatch	Lawrenceburg, Ind.	1879.
William Paul Gerhard, C. E.	New York city.	1880.
Dr. Wolcott Gibbs	Cambridge, Mass.	1876.
Dr. Albert L. Gihon, U. S. N.	Washington, D. C.	1876.
Dr. Alfred C. Girard, U. S. A.	Boisé Barracks, Idaho.	1874.
Dr. Albert C. Gorgas, U. S. N.	Philadelphia, Pa.	1881.
W. H. Graham	St. Louis, Mo.	1884.
Dr. Gabriel Grant	New York city.	1873.
Crosby Gray, Esq.	Pittsburgh, Penn.	1874.
Dr. John Green	St. Louis, Mo.	1884.
Dr. John J. Green	Pittsburgh, Penn.	1884.
Gen. Colton Greene	Memphis, Tenn.	1880.
Dr. E. H. Gregory	St. Louis, Mo.	1884.
Dr. B. M. Griffith	Springfield, Ill.	1880.
Dr. Desault Guernsey	Amenia, N. Y.	1873.
Col. D. P. Hadden	Memphis, Tenn.	1880.
Hon. William H. Halcombe	New Orleans, La.	1880.
Dr. Charles H. H. Hall	Washington, D. C.	1884.
Dr. Junius M. Hall	Chicago, Ill.	1880.
Dr. Willis Hall	St. Louis, Mo.	1884.
Prof. G. Hambach	St. Louis, Mo.	1884.
J. J. Hamlin	Chicago, Ill.	1884.
Dr. D. W. Hand	St. Paul, Minn.	1878.
Dr. W. A. Hardaway	St. Louis, Mo.	1884.
Dr. R. A. Hardin	Nashville, Tenn.	1879.
Dr. M. H. Harding	Lawrenceburg, Ind.	1884.
Dr. Robert B. S. Hargis	Pensacola, Fla.	1878.
Dr. Charles Harrington	Boston, Mass.	1884.
Dr. T. A. Harris	Parkersburg, W. Va.	1884.
Dr. W. J. Harris	St. Louis, Mo.	1884.
Prof. James F. Harrison	University of Virginia.	1878.
Dr. Frank O. Hart	West Unity, Ohio.	1883.
Dr. Henry Hartshorne	Philadelphia, Penn.	1872.
Dr. Edward M. Hartwell	Baltimore, Md.	1884.
Thomas Harvey	Chicago, Ill.	1884.
Dr. W. A. Haskell	Alton, Ill.	1883.
Dr. Thomas Hay	Philadelphia, Penn.	1874.
Dr. Arthur Hazlewood	Grand Rapids, Mich.	1883.
Dr. J. C. Hearne	Hannibal, Mo.	1884.
Dr. Henry F. Hereford	Kansas City, Mo.	1884.
Rudolph Hering, C. E.	Philadelphia, Penn.	1878.
Dr. J. H. Hermann	St. Louis, Mo.	1884.
Dr. Cumberland G. Herndon, U. S. N.	Washington, D. C.	1884.
Dr. H. J. Herrick	Cleveland, Ohio.	1882.
Dr. S. S. Herrick	New Orleans, La.	1878.

Prof. CHARLES N. HEWITT	Red Wing, Minn.	1872.
Dr. D. C. HEWSON	Orange, Texas.	1880.
Dr. JAMES F. HIBBERD	Richmond, Ind.	1881.
Dr. D. B. HILLIS	Keokuk, Iowa.	1880.
Prof. EDWARD HITCHCOCK	Amherst, Mass.	1877.
E. J. HODGSON, Esq.	St. Paul, Minn.	1884.
Dr. KNUT HOEGH	La Crosse, Wis.	1882.
Dr. J. R. HOFFMAN	Athens, Ala.	1884.
Dr. T. E. HOLLAND	St. Louis, Mo.	1884.
Dr. JOSEPH HOLT	New Orleans, La.	1880.
Hon. HENRY D. HOLTON	Brattleborough, Vt.	1875.
Dr. GEORGE HOMAN	St. Louis, Mo.	1879.
Prof. P. O. HOOPER	Little Rock, Ark.	1884.
Dr. HENRY B. HORLBECK	Charleston, S. C.	1880.
Dr. ASA HORR	Dubuque, Iowa.	1872.
Dr. GEORGE HOWE	Columbia, S. C.	1884.
Dr. HENRY F. HOYT	St. Paul, Minn.	1884.
Dr. ADRIAN HUDSON, U. S. N.	Washington, D. C.	1882.
Dr. EZRA M. HUNT	Trenton, N. J.	1872.
Dr. JAMES G. HUNT	Utica, N. Y.	1880.
Dr. HENRY M. HURD	Pontiac, Mich.	1883.
Dr. B. M. HYPES	St. Louis, Mo.	1884.
Dr. J. W. JACKSON	Kansas City, Mo.	1884.
Rev. D. C. JACOKES, S. T. D.	Pontiac, Mich.	1882.
Dr. BUSHROD W. JAMES	Philadelphia, Penn.	1878.
Dr. EDWARD H. JANES	New York city.	1872.
Dr. ANDREW J. B. JENNER	Detroit, Mich.	1883.
Prof. HOSMER A. JOHNSON	Chicago, Ill.	1872.
Dr. SAM C. JOHNSON	Hudson, Wis.	1884.
Dr. E. UTLEE JONES	Taunton, Mass.	1881.
Dr. H. ISAAC JONES	Scranton, Penn.	1880.
C. KALLOCK	Cheraw, S. C.	1884.
Hon. J. M. KEATING	Memphis, Tenn.	1880.
Prof. ROBERT C. KEDZIE	Lansing, Mich.	1873.
Dr. J. H. KELLOGG	Battle Creek, Mich.	1878.
Dr. A. R. KILPATRICK	Navasota, Texas.	1880.
FRANCIS T. KING	Baltimore, Md.	1875.
Dr. J. P. KINGSLEY	St. Louis, Mo.	1884.
Dr. C. B. KINYON	Rock Island, Ill.	1882.
Dr. H. W. KITCHEN	Cleveland, Ohio.	1881.
Dr. CHARLES F. KLAYER	Cincinnati, Ohio.	1881.
Dr. CHARLES KNAPP	Evansville, Ind.	1884.
Dr. ISAAC N. KORLIN	Elwyn, Penn.	1874.
Dr. GEORGE N. KREIDER	Springfield, Ill.	1884.
EMIL KUICHLING, C. E.	Rochester, N. Y.	1882.
Prof. JAMES LAW	Ithaca, N. Y.	1872.
Dr. J. E. LAWRENCE	Columbia City, Ind.	1882.
Dr. THOMAS LAYTON	New Orleans, La.	1880.
Dr. ROBERT LEBBY	Charleston, S. C.	1878.
Dr. BENJAMIN LEE	Philadelphia, Penn.	1874.
Dr. WILLIAM LEE	Washington, D. C.	1874.

Prof. Henry Leffmann	Philadelphia, Penn.	1884.
L. Z. Leiter, Esq.	Chicago, Ill.	1876.
Dr. B. B. Lenoir	Lenoir's, Tenn.	1879.
Dr. B. F. Leonard	Baltimore, Md.	1884.
Dr. William H. Leonard	Minneapolis, Minn.	1882.
Dr. T. B. Lester	Kansas City, Mo.	1884.
Dr. James H. Letcher	Henderson, Ky.	1880.
William P. Letchworth, Esq.	Glen Iris, N. Y.	1874.
Prof. George W. Letterman	Allenton, Mo.	1884.
Dr. H. H. Levy	Richmond, Va.	1878.
Dr. Eugene R. Lewis	Kansas City, Mo.	1884.
Dr. Francis W. Lewis	Philadelphia, Penn.	1874.
Prof. A. Liautard	New York city.	1872.
Prof. C. A. Lindsley	New Haven, Conn.	1875.
Dr. J. Berrien Lindsley	Nashville, Tenn.	1877.
Dr. J. M. Lindsley	Pecan Point, Ark.	1879.
Dr. J. E. Link	Terre Haute, Ind.	1882.
Dr. Frederich Loeber	New Orleans, La.	1880.
Dr. William Lomax	Marion, Ind.	1882.
Dr. Isaac N. Love	St. Louis, Mo.	1884.
Dr. Robert Luedeking	St. Louis, Mo.	1880.
Dr. C. J. Lundy	Detroit, Mich.	1883.
Dr. F. J. Lutz	St. Louis, Mo.	1884.
Dr. J. L. Lyons	New Orleans, La.	1880.
Dr. T. L. Madden	Nashville, Tenn.	1879.
Prof. J. F. Maddox	Shelbyville, Ind.	1882.
Dr. Henry O. Marcy	Boston, Mass.	1883.
Dr. Solon Marks	Milwaukee, Wis.	1876.
Dr. E. J. Marsh	Paterson, N. J.	1872.
Dr. J. S. Mavity	Fowler, Ind.	1882.
Dr. G. W. McCasley,	Fort Wayne, Ind.	1882.
Dr. James McClure	St. Louis, Mo.	1884.
Dr. John H. McCollom	Boston, Mass.	1884.
Dr. J. N. McCormack	Bowling Green, Ky.	1880.
Dr. T. A. McGraw	Detroit, Mich.	1883.
Hon. Albert T. McNeal	Bolivar, Tenn.	1879.
Dr. John A. Mead	Pearlington, Miss.	1880.
Dr. A. H. Meissenbach	St. Louis, Mo.	1884.
Hon. George A. Mercer	Savannah, Ga.	1881.
Dr. Albert Merrell	St. Louis, Mo.	1884.
Henry C. Meyer, C. E.	New York city.	1882.
Dr. John J. Milhau	New York city.	1873.
Prof. Perry H. Millard	Stillwater, Minn.	1884.
Dr. J. L. Million	Springfield, Ill.	1880.
Dr. Hiram R. Mills	Chicago, Ill.	1882.
Prof. John B. Minor	University of Virginia, Va.	1878.
Dr. Charles Mitchell	Nashville, Tenn.	1884.
Dr. Ezra Mitchell	Lancaster, N. H.	1884.
Dr. R. W. Mitchell	Memphis, Tenn.	1878.
Dr. L. H. Montgomery	Chicago, Ill.	1879.
Dr. E. M. Moore	Rochester, N. Y.	1881.

ROBERT MOORE, C. E.	St. Louis, Mo.	1880.
Dr. S. P. MOORE	Richmond, Va.	1878.
Dr. J. CHESTON MORRIS	Philadelphia, Penn.	1883.
Dr. JOHN MORRIS	Baltimore, Md.	1874.
MARTIN MOYLAN	Chicago, Ill.	1884.
Prof. HENRY H. MUDD	St. Louis, Mo.	1882.
Prof. CHARLES E. MUNROE, U. S. N. A.	Annapolis, Md.	1876.
EDWARD MURPHY	Chicago, Ill.	1884.
Dr. JOHN C. MURPHY	Cincinnati, Ohio.	1884.
A. W. MURRAY	Chicago, Ill.	1884.
Dr. ROBERT D. MURRAY, U. S. M. H. S.	Biloxi, Miss.	1872.
Dr. JOHN T. NAGLE	New York city.	1874.
Dr. HERBERT M. NASH	Norfolk, Va.	1878.
J. CRAWFORD NEILSON, C. E.	Baltimore, Md.	1884.
Dr. E. M. NELSON	St. Louis, Mo.	1884.
Dr. F. S. NEWCOMER	Indianapolis, Ind.	1882.
Dr. W. H. NEWELL	Jersey City, N. J.	1882.
Dr. WILLIAM K. NEWTON	Paterson, N. J.	1883.
Dr. EDGAR H. NICHOLS, U. S. M. H. S.	Savannah, Ga.	1882.
Dr. F. G. NICHOLSON	Del Rio, Texas.	1881.
F. A. NIMS, Esq.	Muskegon, Mich.	1883.
Dr. J. B. W. NOWLIN	Nashville, Tenn.	1879.
Dr. R. J. NUNN	Savannah, Ga.	1881.
Dr. WILLIAM OLDRIGHT	Toronto, Canada.	1883.
FRED LAW OLMSTEAD	Brookline, Mass.	1872.
Dr. P. S. O'REILLY	St. Louis, Mo.	1884.
Prof. EDWARD ORTON	Columbus, Ohio.	1874.
Dr. W. B. OUTTEN	St. Louis, Mo.	1884.
FREDERICK N. OWEN, C. E.	New York city.	1883.
Prof. A. B. PALMER	Ann Arbor, Mich.	1883.
Dr. HENRY PALMER	Janesville, Wis.	1877.
Dr. W. THORNTON PARKER, U. S. A.	Newport, R. I.	1884.
Dr. J. M. PARTRIDGE	South Bend, Ind.	1881.
Dr. DEWITT C. PATTERSON	Washington, D. C.	1884.
Dr. W. R. PATTON	Charleston, Ill.	1880.
HENRY E. PELLEW, Esq.	Washington, D. C.	1876.
Maj. GREEN PEYTON	University of Virginia.	1878.
Dr. D. L PHAREZ	Agricultural college, Miss.	1880.
Dr. J. D. PLUNKET	Nashville, Tenn.	1878.
Dr. W. P. POWELL	Willis, Texas.	1880.
Dr. FOSTER PRATT	Kalamazoo, Mich.	1882.
Prof. T. F. PREWITT	St. Louis, Mo.	1884.
Dr. DAVID PRINCE	Jacksonville, Ill.	1880.
Dr. J. N. QUIMBY	Jersey City, N. J.	1884.
Dr. GEORGE E. RANNEY	Lansing, Mich.	1880.
Dr. JOHN H. RAUCH	Springfield, Ill.	1872.
Dr. JOSEPH H. RAYMOND	Brooklyn, N. Y.	1882.
Dr. R. HARVEY REED	Mansfield, Ohio.	1884.
Dr. J. T. REEVE	Appleton, Wis.	1876.
Dr. JAMES E. REEVES	Wheeling, W. Va.	1872.
Dr. FRANK W. REILLY	Springfield, Ill.	1874.

Dr. Charles Reiss	Washington, Mo.	1884.
Dr. B. O. Reynolds	Lake Geneva, Wis.	1884.
Dr. Albert R. Rice	Springfield, Mass.	1884.
Dr. C. T. Richardson	Charleston, W. Va.	1881.
Henry B. Richardson, C. E.	New Orleans, La.	1880.
Prof. J. G. Richardson	Philadelphia, Pa.	1874.
Dr. W. L. Richardson	Boston, Mass.	1875.
Dr. Stephen O. Richey	Washington, D. C.	1884.
Dr. John L. Rison	Huntsville, Ala.	1880.
Dr. A. T. Robertson	Ashmore, Ill.	1880.
Dr. W. S. Robertson	Muscatine, Iowa.	1880.
Samuel A. Robinson	Washington, D. C.	1883.
Dr. James Rodgers	Knoxville, Tenn.	1880.
Dr. Joseph Rogers	Madison, Ind.	1884.
Prof. George H. Rohé	Baltimore, Md.	1880.
Dr. William S. Ross	Madisonville, Ky.	1882.
Dr. Moses T. Runnels	Kansas City, Mo.	1880.
Dr. R. Rutherford	Houston, Texas.	1879.
Dr. D. E. Salmon, D. V. M.	Washington, D. C.	1883.
Dr. L. F. Salomon	New Orleans, La.	1879.
Prof. D. A. Sargent	Cambridge, Mass.	1883.
Dr. D. D. Saunders	Memphis, Tenn.	1879.
Dr. N. J. Sawyier	Frankfort, Ky.	1879.
Dr. E. W. Schaufflin	Kansas City, Mo.	1884.
Dr. Adolph Schlosstein	St. Louis, Mo.	1884.
Geo. D. Scott	New York city.	1884.
Dr. William Selden	Norfolk, Va.	1878.
Jeremiah Sheehan	St. Louis, Mo.	1884.
Simon Shulhafer	Louisville, Ky.	1884.
Dr. T. Grange Simons	Charleston, S. C.	1881.
Dr. C. M. Sitman	Greensburgh, La.	1878.
Dr. Charles Smart, U. S. A.	Washington, D. C.	1882.
Samuel L. Smedley, C. E.	Philadelphia, Penn.	1874.
Dr. David S. Smith	Chicago, Ill.	1880.
Dr. Hanbury Smith	New York city.	1873.
Dr. Joseph R. Smith, U. S. A.	New York city.	1874.
Prof. Stephen Smith	New York city.	1872.
Hon. William J. Smith	Memphis, Tenn.	1878.
Dr. William M. Smith	Stapleton, L. I.	1880.
Prof. William T. Smith	Hanover, N. H.	1884.
Dr. William Snively	Pittsburgh, Penn.	1873.
Dr. Edwin M. Snow	Providence, R. I.	1872.
Prof. George Soulé	New Orleans, La.	1880.
Dr. John C. Spear, U. S. N.	Brooklyn, N. Y.	1881.
Dr. Joseph Spiegelhalter	St. Louis, Mo.	1880.
Dr. Ralph E. Starkweather	Chicago, Ill.	1879.
Eben S. Stearns, D. D.	Nashville, Tenn.	1879.
Dr. A. J. Steele	St. Louis, Mo.	1884.
Hon. Lewis H. Steiner	Baltimore, Md.	1872.
Dr. George M. Sternberg, U. S. A.	Baltimore, Md.	1874.
Dr. James A. Steuart	Baltimore, Md.	1874.

Dr. W. H. Stillwell	Humboldt, Tenn.	1879.
Dr. J. P. Stoddard	Muskegon, Mich.	1883.
Dr. L. T. Stone	Galesburg, Ill.	1880.
Jeremiah Strahan	St. Louis, Mo.	1884.
Dr. William Sullivan	Rising Sun, Ind.	1884.
Rev. J. T. Sunderland	Ann Harbor, Mich.	1884.
Dr. George Sutton	Aurora, Ind.	1884.
Dr. R. M. Swearingen	Austin, Texas.	1880.
Dr. R. F. Talley	Belton, Texas.	1880.
Albert B. Tavel	Nashville, Tenn.	1879.
Dr. St. George W. Teackle	Baltimore, Md.	1884.
Dr. John Gillett Thomas	Wilmington, N. C.	1881.
Dr. A. A. Thompson	Flint, Mich.	1883.
Dr. C. A. Thompson	Jefferson City, Mo.	1884.
Dr. Pinckney Thompson	Henderson, Ky.	1879.
Dr. G. B. Thornton	Memphis, Tenn.	1879.
Dr. Wm. Oscar Thrailkill	San Francisco, Cal.	1884.
Prof. Charles A. Todd	St. Louis, Mo.	1880.
Dr. Joseph M. Toner	Washington, D. C.	1872.
Dr. Luther C. Toney	Trenton, Ill.	1884.
Dr. Smith Townshend	Washington, D. C.	1879.
Dr. George E. Trescott	Greenville, S. C.	1878.
Dr. Thomas J. Turner, U. S. N.	Washington, D. C.	1877.
Hon. C. V. Tyler	Bay City, Mich.	1883.
Dr. W. C. Van Bibber	Baltimore, Md.	1875.
Dr. J. H. Van Deman	Chattanooga, Tenn.	1873.
Prof. C. C. Vanderbeck	Philadelphia, Penn.	1884.
Dr. E. V. Van Norman	Springfield, Ohio.	1882.
Dr. B. A. Vaughan	Columbus, Miss.	1882.
Dr. R. A. Vaughan	St. Louis, Mo.	1884.
Prof. Victor C. Vaughan	Ann Arbor, Mich.	1883.
Dr. W. W. Vinnedge	Lafayette, Ind.	1882.
Dr. Tullio S. Verdi	Washington, D. C.	1880.
J. J. Wade	Chicago, Ill.	1884.
Dr. Henry P. Walcott	Cambridge, Mass.	1880.
Dr. Edwin Walker	Evansville, Ind.	1884.
Shippen Wallace, Ph. D.	Burlington, N. J.	1884.
Dr. J. P. Wall	Tampa, Fla.	1875.
Dr. Ralph Walsh	Washington, D. C.	1884.
Dr. Horace Wardner,	Anna, Ill.	1877.
Col. George E. Waring, C. E.	Newport, R. I.	1875.
Dr. A. P. Warterfield	Union City, Tenn.	1879.
Dr. M. H. Waters	Terre Haute, Ind.	1882.
Dr. W. H. Watkins	New Orleans, La.	1880.
Dr. Irving A. Watson	Concord, N. H.	1881.
Dr. J. Madison Watson	Elizabeth, N. J.	1882.
Dr. R. D. Webb	Livingston, Ala.	1878.
Dr. Warren Webster, U. S. A.	Washington, D. C.	1873.
Dr. John B. Weever	Mount Vernon, Ind.	1884.
F. W. Wessler	St. Louis, Mo.	1884.
Dr. William C. Wey	Elmira, N. Y.	1872.

Hon. Andrew D. White	Ithaca, N. Y.	1872.
Dr. Charles H. White, U. S. N.	Washington. D. C.	1884.
Dr. Octavius A. White	New York city.	1876.
Dr. William White	Franklin, Tenn.	1879.
Dr. O. W. Wight	Detroit, Mich.	1879.
E. P. Williams, Esq.	Galesburg, Ill.	1880.
Dr. O. L. Williams	Chapel Hill, Texas.	1880.
Mrs. S. R. Williams	Chapel Hill, Texas.	1880.
Dr. H. L. Williford	Shelby County, Tenn.	1884.
Prof. T. P. Wilson	Ann Arbor, Mich.	1879.
W. H. Wilson	Weldon, Texas.	1880.
Rev. Frederick H. Wines	Springfield, Ill.	1876.
Dr. G. F. Witter	Grand Rapids, Wis.	1877.
Prof. Edward S. Wood	Boston, Mass.	1876.
Dr. Thomas F. Wood	Wilmington, N. C.	1878.
Dr. J. H. Wooden	Greensburgh, Ind.	1884.
Dr. Alfred A. Woodhull, U. S. A.	David's Island, N. Y.	1874.
William E. Worthen, C. E.	New York city.	1872.
Dr. A. R. Wright	Buffalo, N. Y.	1881.
Dr. Walter Wyman, U. S. M. H. S.	Baltimore, Md.	1884.
Andrew Young	Chicago, Ill.	1884.

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Hon. B. L. Butcher	Wheeling, W. Va.	1883.
Dr. J. Charles Cabanné	St. Louis, Mo.	1884.
J. H. Chambers, Esq.	St. Louis, Mo.	1884.
Charles R. Corning, Esq.	Concord, N. H.	1884.
Prof. James P. Dixon	New London, N. H.	1884.
E. W. Donk, Esq.	St. Louis, Mo.	1884.
Hon. W. L. Ewing	St. Louis, Mo.	1884.
Louis W. Fasquelle	St. John, Mich.	1883.
M. Francis Fasquelle	Mt. Pleasant, Mich.	1883.
David Ferguson	Detroit, Mich.	1883.
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W. W. Harris, Esq.	Birch Hill, Mo.	1884.
Dr. Wallace J. Herriman	Rochester, N. Y.	1884.
*Dr. Carl H. Horsch	Dover, N. H.	1883.
Dr. Garland Hurt	St. Louis, Mo.	1884.
Elias S. Hutchinson, Esq.	Washington, D. C.	1884.
William J. Lemp, Esq.	St. Louis, Mo.	1884.
M. H. McLean, Esq.	St. Louis, Mo.	1884.
N. O. Nelson, Esq.	St. Louis, Mo.	1884.
Dr. J. Perkins	Owosso, Mich.	1883.
C. C. Rounds, Ph. D.	Plymouth, N. H.	1884.
Dr. Thomas H. Ryan	New Orleans, La.	1884.
Xavier Ryan, Esq.	Colorado City, Texas.	1884.

* Transferred to Active Class, 1885.

Col. Shaler Smith, C. E.	St. Louis, Mo.	1884.
Charles Speck, Esq.	St. Louis, Mo.	1884.
H. C. Townshend, Esq.	St. Louis, Mo.	1884.
Walter F. Wells, Esq.	Melrose, Mass.	1884.

HONORARY MEMBERS.

Mrs. Elizabeth Thompson	New York city.	1878.
President Grover Cleveland	Washington, D. C.	1885.

LIFE MEMBER.

Mr. Henry Lomb	Rochester, N. Y.	1885.

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ERRATUM.

On page 324, for "Dr. Adams" read Dr. S. W. Abbott.